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Vol. 45. Ser. A. Part 5. pp. 161–208. MAY, 1957.

THE REVIEW OF APPLIED ENTOMOLOGY

SERIES A: AGRICULTURAL

ISSUED BY THE COMMONWEALTH INSTITUTE OF ENTOMOLOGY.

LONDON:
COMMONWEALTH INSTITUTE OF ENTOMOLOGY,
56, QUEEN'S GATE, S.W.7.

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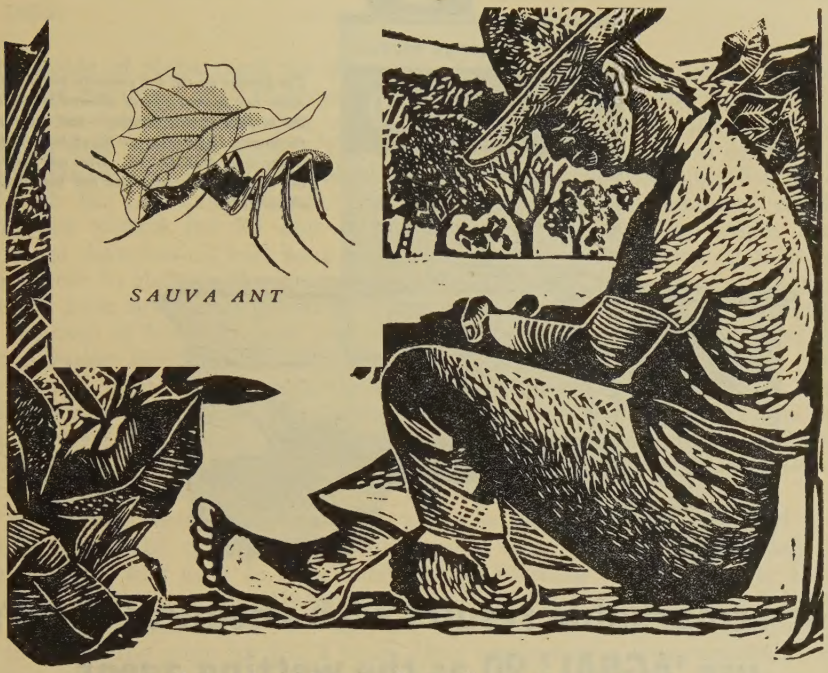

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TREATMENT	PERCENTAGE OF 'PERENOX' IN SPRAY FLUID	MEAN NUMBER OF SPOTS PER LEAF	
		April 26th	May 20th
'PERENOX'	0.25	12	109
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Phillips (G. L.). **Grain Fumigation.**—*Agric. Chem.* **10** no. 1 pp. 55–56, 117–121; no. 2 pp. 41–43, 133, 135, 9 figs., 6 refs. Baltimore, Md., 1955.

The holds of ships used for the storage of surplus wheat in the United States are equipped with mechanical aeration systems, and the possibility of using these for the circulation of gases during fumigation of the grain was tested in four holds in 1954. The aeration system and method of using it in fumigation are described. Methyl bromide was applied at 0·6–0·66 or 1·82–1·83 lb. per 1,000 cu. ft. and recirculated at the beginning of the fumigation period for 30 and 60 minutes, respectively, by which time maximum distribution had been obtained, and the system was operated as for aeration to remove the fumigant after 24 hours. Gas samples taken at intervals from numerous positions in the holds showed adequate distribution and removal of the fumigant and indicated that the air-flow rates used for grain aeration (0·024–0·043 cfm per bushel) are sufficient to produce good distribution of methyl bromide throughout the grain. No test insects were used, but a heavy natural infestation of the flour beetle [*Tribolium*], the flat grain beetle [*Cryptolestes minutus* (Ol.)] and the lesser grain borer [*Rhizopertha dominica* (F.)], together with a few rice weevils [*Calandra oryzae* (L.)], in one hold was eliminated by the higher dosage.

A temporary recirculation system, which is described, was installed in a grain elevator 135 ft. high filled with maize that was to be fumigated for 24 hours. It was used to distribute methyl bromide at 12·8 oz. per 1,000 cu. ft. in three tests, the air-flow rates being 0·0201 cfm per bushel for 85 minutes and 0·0245 and 0·0317 cfm per bushel for 75 minutes, respectively, and to aerate the grain for 2·5–3 hours after fumigation. Gas concentrations determined at intervals at different points in the elevator showed fairly uniform distribution and adequate removal of the fumigant in all tests. It is considered that such systems will also be satisfactory for other fumigants and will increase the efficiency and reduce the cost of treatment.

Watters (F. L.). **Pyrethrins-Piperonyl Butoxide as a residual Treatment against Insects in Elevator Boots.**—*Cereal Chem.* **33** no. 2 pp. 145–150, 5 refs. St. Paul, Minn., 1956.

As the cereal that remains in the elevator boots of flour mills is often infested by insects, experiments were carried out in a mill in Canada on the effectiveness of pyrethrins with piperonyl butoxide for their control. About 6–8 lb. stock from each elevator boot was treated with insecticide at 1 ml. per 50 gm. and returned, and samples taken before treatment and five weeks later were incubated at 75°F. and 75 per cent. relative humidity for two weeks and examined for living pupae and adults of *Tribolium confusum* Duv. and *Cryptolestes minutus* (Ol.) (*Laemophloeus pusillus* (Schönh.)), which made up 99 per cent. of the insects present. Solutions of 2·5, 1·5 and 0·5 per cent. pyrethrins, each with ten times as much piperonyl butoxide, in deodorised kerosene were found to cause highly significant, significant and no significant reductions in infestation, respectively, as compared with untreated boots.

As insects from infested elevator boots may be carried to other equipment in the mill with the stock passing through, and laboratory tests had shown that *Tribolium* adults become paralysed when placed on flour impregnated with pyrethrins and piperonyl butoxide, their behaviour when added to

(2361) Wt. P8510/3911 5/57 E.P. Ltd. Gp. 566. [A]

untreated flour and flour treated with the mixture at the highest concentration in elevator boots was examined, the elevator being operated for an hour. More insects were found to have remained in the treated than in the untreated flour, and all in the former were paralysed, whereas those in the untreated flour moved rapidly, often into positions from which they were transferred to stock passing through the boots.

Tests with flour that had passed through elevator boots containing stock treated with the highest concentration of insecticide showed a faint odour in loaves from a sample taken immediately after the elevator was started; slight odour was detected in five further samples of flour taken at two-minute intervals, but this disappeared after baking. The insecticide had no specific effect on the colour or texture of the bread.

Ely (R. E.) & others. **Excretion of Dieldrin in the Milk of Cows fed Dieldrin-sprayed Forage and technical Dieldrin.**—*J. Dairy Sci.* **37** no. 12 pp. 1461–1465, 11 refs. Lancaster, Pa., 1954. **Excretion of Heptachlor Epoxide in the Milk of Dairy Cows fed Heptachlor-sprayed Forage and technical Heptachlor.**—*Op. cit.* **38** no. 6 pp. 669–672, 5 refs. 1955.

These two papers contain the results of investigations carried out in Maryland in 1952–53, in which dairy cows were fed for various periods with hay prepared from lucerne that had been sprayed in the field with dieldrin or heptachlor and subsequently with untreated hay and various quantities of technical dieldrin or heptachlor, dissolved in soy-bean oil and administered twice a day by capsule, in order to assess contamination of their milk. Two plots of lucerne were treated with 3·5 and 7 oz. dieldrin and two with 3·8 and 8 oz. heptachlor, respectively, in about 6 U.S. gals. emulsion spray per acre on 7th July 1952, and the lucerne was cut seven days later and field-cured, field-baled and stored until used, when it bore average residues of 0·4 and 2·9 parts per million dieldrin and 1·2 and 5 p.p.m. heptachlor, respectively.

Four cows were allowed to eat as much hay as they would from the first dieldrin plot from 15th November to 27th February and from the second from 28th February to 15th April. They ingested 0·09–0·11 and 0·69–0·83 mg. dieldrin per kg. body weight per day during the two periods, and the concentrations of dieldrin in the fat-corrected milk were found to be 0·7–1 and 1·4–2·2 p.p.m., respectively. They then received 50–800 mg. dieldrin per day in capsules for the next 50 days and 100–1,000 mg. for another 40 (equivalent to 0·11–1·81 and 0·22–2·32 mg. per kg. per day), and the concentrations in the fat-corrected milk were 1·7–9·7 and 1·7–13·1 p.p.m., respectively, during the two periods and 0·8–2·7 p.p.m. 47 days after the end of the second.

Four other cows were fed with hay from the two heptachlor plots from 15th November to 5th January and from 6th January to 27th February, respectively. They ingested 0·03 and 0·1–0·13 mg. heptachlor per kg. body weight per day, but excreted no heptachlor or heptachlor epoxide (to which heptachlor is metabolised) in the milk. The same cows and others were then given 100–1,000 mg. heptachlor per day in capsules for the next 50 days and 300–1,800 mg. for another 70 (0·3–2·12 and 0·6–3·78 mg. per kg. per day). No heptachlor or heptachlor epoxide was detected in the milk of the animals receiving less than 500 mg. per day, but there were concentrations of 0·2–5·7 p.p.m. of the metabolite in fat-corrected milk from those receiving 500 mg. and higher doses. It is concluded that forage harvested

at least a week after being sprayed with heptachlor at the unusually high rate of 8 oz. per acre is safe for livestock; animals that fed on such hay received about one tenth of the amount needed for the excretion of perceptible amounts of the metabolite in the milk.

Brown (W. B.) & Heuser (S. G.). **Behaviour of Fumigants during Vacuum Fumigation. III. Penetration of Methyl Bromide into bagged Whalemeat Meal.**—*J. Sci. Fd Agric.* **7** no. 9 pp. 595–601, 8 graphs, 7 refs. London, 1956.

In further investigations on the penetration of methyl bromide applied by various fumigation techniques into industrial commodities [*cf. R.A.E.*, A **42** 145, etc.] tests were made with single 168-lb. bags of whalemeat meal with a moisture content of 5·4 per cent., in a 1,700-litre steel chamber at a temperature of 15°C. [59°F.] and 70 per cent. relative humidity. Exposure for four hours to a nominal concentration of 60–65 mg. per litre at atmospheric pressure, in vacuum fumigation with simultaneous admission of air and fumigant or in vacuum fumigation with atmospheric pressure restored immediately after application of the fumigant resulted in penetration factors [*cf.* **41** 350] of 0–1 at the centre of the bags and of only 13, 19 and 27, respectively, at a depth of three inches, indicating extremely rapid sorption in the outer layers. After two air-washing cycles [*cf.* **41** 350], storage for seven days and further airing for 48 hours, the residues of chemically combined bromide were 61–75 parts per million at the centre and 80–89 p.p.m. at a depth of three inches. The disproportionately high residues at the centre must have been due to fumigant remaining within the bags for considerable periods after removal from the fumigating chamber, and continued diffusion of gas from the outer to the inner layers of meal was indicated by higher concentrations at the centre after airing for 24 hours than immediately after fumigation. Fumigation with a nominal dosage of 40 mg. per litre at atmospheric pressure for 24 and 48 hours resulted in adequate penetration factors of 16 and 25 at the centre and 32 and 35 at a depth of three inches; residual bromide varied from 206 p.p.m. at the centre to 258 p.p.m. at the surface nine days after treatment for 48 hours. Restoring atmospheric pressure one and two hours after the beginning of a four-hour exposure resulted in lower and higher penetration factors, respectively, than would have been obtained if reduced pressure had been maintained for the full exposure, and the optimum time for restoring pressure appeared to be between the two. Restoring atmospheric pressure had much less effect at the centre of the whalemeat than at the centre of wheatfeed [*cf.* **42** 145], and, in contrast to the latter, the resultant concentration was greater at a depth of three inches than at the centre. Two air-washing cycles, though not very effective in removing the fumigant, were better than a procedure in which the fumigant in the free space was swept away by forced ventilation for one hour, leaving concentrations of 3·6–7·3 mg. per litre at the centre and 1·5–3 mg. at a depth of three inches after airing for 24 hours, as compared with 17·7 and 8·6 mg. for forced ventilation.

In view of the high degree of adsorption of the fumigant by whalemeat meal and the length of time for which effective concentrations remained at the centre of the bag after airing, there is danger of tainting or other damage and the formation of undesirably high chemical residues, and it is suggested that continuous evacuation of the chamber combined with controlled admission of air over 1–2 hours may be desirable, to sweep away the fumigant from the free space, the absolute pressure being maintained at

about 10 cm. mercury. The higher sorption and more restricted penetration of methyl bromide in whalemeat meal than in wheatfeed is in accordance with its much smaller intergranular space and higher protein content.

Habib (A.). **Some biological Aspects of the** *Eulecanium corni* **Bouché-group (Hemiptera: Coccidea).**—*Bull. Soc. ent. Egypte* **39** pp. 217–228, 5 graphs, 15 refs. Cairo, 1955. **The Behaviour of the nymphal Stages of** *Eulecanium corni* **Bouché (Hemiptera Coccidea).**—*T. c.* pp. 229–249, 13 figs., 3 refs.

In the first of these papers, the author gives the results of investigations in England on the synonymy, food-plants and bionomics of *Eulecanium corni* (Bch.). This Coccid is highly polyphagous and differs somewhat in appearance on its various food-plants. A study of these forms, many of which have been given varietal names, showed that these are all synonyms of *E. corni*, including var. *robiniarum* (Dougl.) on *Robinia pseudacacia* [*cf. R.A.E.*, A **18** 4] and var. *crudum* Green on *Aralia* [**6** 59], though records of the latter on yew (*Taxus baccata*) in England [**18** 229; **22** 362; **33** 171] were found to refer to a distinct species that was to be described as *E. taxi*, sp. n. A list is given of the known food-plants of *E. corni*, with indications of those on which it was observed by the author in England.

E. corni had only one generation a year. Eggs were laid in the first half of May, and they hatched in late May in the greenhouse and late June in the field. The nymphs overwintered, and adults were present from March or early April in the greenhouse and from late April in the field. Reproduction was usually parthenogenetic, but males formed about 4 per cent. of the population on *Cotoneaster microphylla*. In detailed observations carried out in the greenhouse and the field, the preoviposition period, egg stage and two nymphal instars lasted 29 and 25, 22 and 36, 54 and 58, and 255 and 255 days, respectively, on blackberry, and 25 and 27, 17 and 31, 59 and 59, and 256 and 253 days on peach. The temperature at which the eggs hatched averaged 61°F. in the greenhouse and 59°F. in the field, which probably accounted for the differences in the length of the egg stage. Detailed investigations on the effect of temperature showed that the duration of the egg stage decreased from 25 days at 18°C. [64·4°F.] to 8·7 days at 33°C. [91·4°F.] and that egg mortality was about 20 per cent. at 18–25°C. [64·4–77°F.], 75 per cent. at 33°C. and 100 per cent. at 35°C. [95°F.]. Nymphs of the species on *Taxus* were much less active than those of *E. corni* and became fixed on the lower surface of the leaflets or the lower side of the leaf stalk by late autumn. It also had one generation a year, and the durations of the various stages were similar to those for *E. corni*.

Observations on nymphal mortality were made by counting the population on various plants at monthly intervals from August to May. By May, 42, 23, 21 and 2 per cent. of the original population of *E. corni* survived on *C. microphylla*, *Ribes sanguineum*, peach and blackberry, respectively, and only 38 per cent. of the *Taxus* species survived on *T. baccata*. Reasons for the differences are discussed.

The second paper comprises an account of laboratory investigations on the factors influencing the orientation of the nymphs of *E. corni*. Nymphs in the first instar were positively phototactic, which was apparently responsible for their moving first towards the tips of the branches. In the second instar, they became positively geotactic and strongly photokinetic. They also exhibited a preference for both upright and horizontal dark objects, and these factors, together with a tendency in this instar to be oriented upside down, may account for the occurrence of the second-instar

nymphs on the lower surfaces of leaves and horizontal branches and on the lower, shaded parts of vertical stems. The nymphs tended to prefer temperatures between 21 and 27°C. [69·8 and 80·6°F.] and relative humidities between 60 and 80 per cent.

KHALIFA (A.) & BADAWY (A.). **The Effect of Nutrition on the Biology of *Tribolium confusum* Duv., *Tribolium castaneum* Hbst., and *Latheticus oryzae* Waterh. (Coleoptera: Tenebrionidae).**—*Bull. Soc. ent. Egypte* **39** pp. 337–350, 4 graphs, 19 refs. Cairo, 1955.

In the first of the laboratory tests described, which was carried out at an average temperature of 27·3°C. [81·14°F.] and an average relative humidity of 62 per cent., the durations of the larval and pupal stages of *Tribolium castaneum* (Hbst.) and the period from egg to adult averaged 21·4, 7·7 and 32·7 days, respectively, in whole-wheat flour, 23·8, 7·9 and 35·5 days in whole-maize flour, 26·2, 7·7 and 37·6 days in crushed wheat grains and 32·3, 9·3 and 45·2 days in crushed maize grains. The number of larvae provided with the four types of food were 47, 46, 39 and 42, respectively, and 45, 44, 27 and 29 completed their development. Most of the dead larvae in the crushed grains were in the early instars. In a second test, at 29·2°C. [85·56°F.] and 59·9 per cent. relative humidity, the corresponding figures for the duration of development averaged 22·5, 6·3 and 33·4 in whole-wheat flour, 24·6, 6·2 and 35·5 in whole-maize flour, 22·2, 6·3 and 33·1 in sieved wheat flour, 21·6, 6·4 and 32·6 in wheat bran and 29, 6·1 and 39·8 in polished rice flour for *T. castaneum*, 25·3, 6·7 and 38·4 in whole-wheat flour, 27·8, 6·5 and 40·7 in maize flour, 25·8, 6·6 and 38·9 in sieved wheat flour, 24·6, 6·7 and 37·9 in wheat bran and 32·8, 6·4 and 45·4 in rice flour for *T. confusum* Duv., and 29·3, 5·4 and 41·5 in whole-wheat flour, 56·7, 5 and 68·4 in maize flour, 26·2, 5·6 and 38·6 in sieved wheat flour, 27·6, 5·5 and 39·9 in wheat bran and 36·2, 5·2 and 48·1 in rice flour for *Latheticus oryzae* Waterh. There was 72·5 per cent. mortality among the larvae of *L. oryzae* in maize flour. Observations on the number of larval instars in the three species on the various foods are recorded.

The numbers of eggs laid by females of the three species during the first month after emergence was investigated by isolating individual pairs in the type of food in which they had been reared. The temperature averaged 29·9°C. [85·82°F.] and the relative humidity 59·7 per cent. For *T. castaneum*, the numbers laid per female averaged 298·2 in whole-wheat flour, 169·6 in whole-maize flour and 47·4 in rice flour, and the corresponding figures were 330·8, 207·8 and 67·8 for *T. confusum* and 206·6, 140 and 32·8 for *L. oryzae*.

The effect of the various products on population density was investigated by confining ten males and ten females with 100 gm. food and counting the numbers of individuals (in all stages) present after two months. The temperature averaged 28·7°C. [83·66°F.], and the relative humidity 61·8 per cent. For *T. castaneum* and (in brackets) *L. oryzae*, the totals were 410 (356) in whole-wheat flour, 54 (20) in crushed wheat grains, 222 (129) in whole-maize flour, 25 (20) in crushed maize grains, and 23 (9) in polished rice grains. No insects of either species developed in whole grains of wheat or maize or in unpolished rice. In a further test, at an average temperature of 29·2°C. [85·56°F.] and relative humidity of 64·9 per cent., ten males and ten females were confined with 200 gm. food. The total numbers at the end of two months in whole-wheat flour, whole-maize flour, wheat bran and polished rice flour were 613, 524, 700 and 161, respectively, for *T. castaneum*,

1,292, 857, 1,337 and 189 for *T. confusum*, and 296, 113, 443 and 117 for *L. oryzae*.

Khalifa (A.) & Badawy (A.). **Biological Studies on** *Tribolium confusum* **Duv.,** *Tribolium castaneum* **Hbst., and** *Latheticus oryzae* **Waterh. (Coleoptera: Tenebrionidae).**—*Bull. Soc. ent. Egypte* **39** pp. 351–373, 7 graphs, 28 refs. Cairo, 1955.

An account is given of observations on the bionomics of *Tribolium castaneum* (Hbst.), *T. confusum* Duv. and *Latheticus oryzae* Waterh. in wholewheat flour, carried out in the laboratory from July 1951 to July 1952. During this period, the average monthly temperature ranged from about 30°C. [86°F.] in July and August to about 14°C. [57·2°F.] in January, and the average monthly relative humidity from about 50–60 per cent. in July to nearly 80 per cent. in January. Insects were reared so far as possible from eggs laid in the first week of each month.

The average durations of the egg stage for the three species ranged from minima of 3·5, 4·9 and 4·4 days, respectively, in July or August to maxima of 12·2, 13·6 and 17·9 days, in April, November and April, respectively. About 80–95 per cent. of the eggs of *Tribolium* spp. and 75–95 per cent. of those of *Latheticus* hatched. No eggs were laid by *Tribolium* between mid-November and mid-March or by *Latheticus* between late October and late March; those laid during December, January and February by females kept at 28°C. [82·4°F.] failed to hatch when removed to the laboratory, where the average temperatures were 15, 14·5 and 16°C. [59, 58·1 and 60·8°F.], respectively. Larval development was most rapid in July–August, the minimum average periods being 21·1, 23·3 and 25·1 days for *T. castaneum*, *T. confusum* and *L. oryzae*, respectively. All larvae of *T. castaneum* present in early November died in the second instar before the end of the winter, mostly between 7th and 20th December, when the temperature averaged 15·8°C. [60·44°F.]. A few larvae of *T. confusum* survived the winter and completed their development in March–April, and the remainder died, mostly between 6th and 18th February, when the temperature also averaged 15·8°C. Most larvae of *L. oryzae* died during the winter, but a few completed their development in April. Many larvae of this species that hatched from eggs laid in April died later in that month during a period of low temperatures, averaging 20·2°C. [68·36°F.].

The pupal stage was shortest in July, when it averaged 5·8, 6·3 and 5·1 days for *T. castaneum*, *T. confusum* and *L. oryzae*, respectively, and longest in September or October, the maximum averages being 18·5, 19·2 and 7·7 days. The preoviposition period ranged from 4·9, 6·2 and 5·7 days for the three species in June to 129·2, 125·3 and 197 days for adults that emerged in September–October. Similar data are given for total development, which was shortest in July–August (averaging 30·6–30·8, 35–35·1 and 35–37·1 days for the three species), and it is concluded that the number of generations a year is about six for *T. castaneum*, 5–6 for *T. confusum* and 4–5 for *L. oryzae*. Observations on egg-production showed that the total numbers of eggs laid per fertilised female averaged 516·2 for *T. castaneum*, 1,069 for *T. confusum* and 330 for *L. oryzae*. Eggs laid by unfertilised females did not hatch. The species of *Tribolium* laid their highest numbers of eggs in June–July and *Latheticus* in September.

When kept without food, adults of the three species survived for 15·1–17·9, 13·6–18 and 8·1–10·2 days, respectively. Under similar conditions, last-instar larvae pupated and gave rise to adults, but younger individuals did not, though they sometimes completed a further moult.

Attiah (H. H.). **A new Eriophyid Mite on Mango from Egypt (Acarina).** —*Bull. Soc. ent. Egypte* **39** pp. 379–383, 16 figs., 3 refs. Cairo, 1955.

Descriptions are given of the adults of both sexes of *Vasates mangiferae*, sp.n., which was found in March 1953 attacking the terminal buds and inflorescences of mango at Giza, near Cairo, and appears to be of considerable importance. The infested parts become discoloured and ultimately dry up, but there is no production of lateral buds such as occurs after attack by *Aceria mangiferae* Taher Sayed [*cf. R.A.E.*, A **36** 409], which was also present on some of the trees. Characters are given differentiating the two species. About 96 per cent. mortality of *Vasates* was given by spraying with 1 per cent. wettable sulphur.

Hammad (S. M.). **On some Dipterous Leaf-miners from Egypt.**—*Bull. Soc. ent. Egypte* **39** pp. 391–394, 5 figs., 9 refs. Cairo, 1955.

The leaf-miners recorded, all of which were observed near Alexandria, are the Agromyzids, *Liriomyza congesta* (Beck.) (*trifolii* (Burgess)), on broad beans (*Vicia faba*) and peas, *Agromyza nana* Mg., on *Trifolium alexandrinum*, and *Phytomyza atricornis* Mg., on *T. alexandrinum*, *Melilotus indica*, *Sonchus oleraceus* and turnip, and the Anthomyiid, *Pegomyia hyoscyami* var. *betae* (Curt.), on beet, spinach and *Chenopodium murale*. The damage caused is briefly described, and the mines and the arrangements of the frass in them, which serve as differentiating characters, are illustrated.

Ibrahim (M. M.). **Studies on** *Coccinella undecimpunctata aegyptiaca* **Reiche. I. Preliminary Notes and Morphology of the early Stages (Coleoptera: Coccinellidae).**—*Bull. Soc. ent. Egypte* **39** pp. 251–274, 44 figs., 25 refs. Cairo, 1955. **II. Biology and Life-history (Coleoptera: Coccinellidae).**—*T. c.* pp. 395–423, 19 figs., 16 refs.

Coccinella undecimpunctata L. is an important predator of Aphids and other insects in Egypt [*cf. R.A.E.*, A **40** 22; **41** 415], where it is represented by race *aegyptiaca* Reiche, and in the first part of this paper, the author summarises its distribution and host preferences and describes the immature stages in detail. The second part comprises an account of observations on its bionomics.

There were two main generations a year in the field, with a further partial one in summer. Eggs laid in December–March gave rise to adults in February–May, and some of the females oviposited in May–June, giving rise to further adults in July–September. These and the remaining females from the earlier generation oviposited in August–October, the adults of the resulting generation emerging from late September onwards. As a result of overlapping, adults were present throughout the year. Observations are recorded on the duration of development in the laboratory and in the field; in the latter, the egg, larval and pupal stages averaged 2·5, 5·5 and 2 days in summer and 13, 45·5 and 8·5 days in winter. When nymphs of *Aphis durantae* Theo. were provided daily, the larvae consumed 419 each at 25·5°C. [77·9°F.] in the laboratory during a larval stage averaging 13·5 days, and 458 each at 14·5°C. [58·1°F.] in the field, during a larval stage averaging 45 days. The larvae usually failed to complete their development when fewer than 15 Aphids each were provided per day, and their rate of development increased as the daily number provided rose from 15 to 45, but not beyond this limit. The size of the resulting adults increased with the numbers of Aphids supplied to the larvae. Adults of the two sexes were

present in almost equal numbers and paired within about a day of emergence. The preoviposition period lasted 2–4 days at 29°C. [84·2°F.] and 12–14 days at 14°C. [57·2°F.], and the females laid average totals of 746, 653 and 451 eggs at average temperatures of 27, 25 and 14°C. [80·6, 77 and 57·2°F.], respectively. Observations on the numbers of eggs laid daily are recorded. A minimum of 30–40 Aphids per day appeared necessary for oviposition, and the number of eggs laid increased with the Aphid supply up to a limit of 65 Aphids per day. When eggs of *Phenacoccus hirsutus* Green, newly-hatched larvae of *Prodenia litura* (F.) or drops of honey and water were provided as food, no eggs were laid. Males survived for 61 days when the daily numbers of Aphids provided for each was 75, and females for 65 days when it was 65–75. Adults kept without food or water survived for 3–4 days at 26°C. [78·8°F.] and six days at 14°C. Survival was longest (up to about 140 days) when honey and water were provided; eggs of *Prodenia* and nymphs of *Phenacoccus* appeared to be less attractive, and survival was considerably shorter when these alone were provided. It appears unlikely, therefore, that *C. undecimpunctata* is of importance in the control of *Prodenia*, as has been suggested [**41** 415]. During the summer, when Aphids are not available, the adults of *C. undecimpunctata* probably feed on nectar.

The larvae, pupae and adults of *C. undecimpunctata* were parasitised by *Perilitus coccinellae* (Schr.), one example of which developed in each host. The full-fed larva of this Braconid emerges from the adult host and pupates beneath it; the host dies 1–2 days later. The percentage parasitism was about 6·4 in March–June, 0–1 in August–September and 3 in November–December. A few of the pupae of *Perilitus* were parasitised by an unidentified Pteromalid. *Tetrastichus coccinellae* Kurd., which parasitises the last-instar larvae, prepupae and newly-formed pupae of *C. undecimpunctata*, was obtained in small numbers from field-collected material, a single host pupa giving rise to 4–18 parasites.

McKinlay (K. S.). **Cotton Pest Control in the Eastern Province, Tanganyika.**—*E. Afr. agric. J.* **22** no. 1 pp. 20–23. Nairobi, 1956.

In experiments on the control of cotton pests in Eastern Province, Tanganyika, in 1955, the potential cotton yield was first determined by spraying the crop to run-off six times, at weekly intervals, with an emulsified solution of 0·1 per cent. DDT and 0·025 per cent. γ BHC, to prevent, as far as possible, all attack by insects. Untreated plots suffered heavy infestation early in the season by *Empoasca* sp. and later by *Earias* sp. and *Heliothis armigera* (Hb.). Weekly counts were made of the numbers of flower buds attacked by the two Lepidoptera, and the average numbers per week throughout the season on 20 untreated and (in brackets) on 20 treated plants were 8·38 (2·99), 22·86 (1·34) and 30·4 (0·28) for cotton sown on 28th January, 28th February and 29th March, respectively. The corresponding yields, in lb. seed cotton per acre, were 1,733 (3,191), 482 (2,469) and 94 (1,630), respectively. The longer growing season of the earliest-sown cotton thus resulted in a good yield in spite of severe insect attack. Since destruction of buds by insects does not always result in loss of yield, the plant usually producing more buds than it can mature, a further test was made to ascertain the latest date at which treatment should be begun, so as to prevent yield reductions with the minimum number of applications. Cotton was sown on 28th January, 28th February and 29th March, all plots were protected from insect attack by weekly applications of the spray of DDT and BHC, and all flower buds were removed by hand at weekly intervals for one, two or three months after the appearance of the first one. The yields,

in lb. seed cotton per acre, from plots sown on the three dates, respectively, were 2,502, 1,415 and 605 when the buds were removed over one month, 2,003, 1,343 and 482 when they were removed over two months, and 1,636, 727 and 281 when they were removed over three months, as compared with 2,743, 1,757 and 899 in the controls. Analysis showed that the effect of loss of buds for a given period was the same regardless of planting date and that complete loss for the first month did not significantly reduce the yield for the earliest sowing, though this may depend on local conditions.

In a test of insecticides, cotton sown on 14th February was treated weekly against *Heliothis* and *Earias* with low-volume sprays of 0·25, 1 or 2 lb. dieldrin, aldrin, endrin or DDT in 12 gals. per acre, alone or with the addition of 0·25 lb. γ BHC per acre against *Aphis gossypii* Glov., infestation by which failed to develop, however, possibly owing to the early date of sowing. Yields and costs are compared in a table and discussed. Endrin at 2 lb. per acre appeared somewhat phytotoxic and resulted in a lower yield than at 1 lb. It proved more effective at this rate, but also more expensive, than aldrin or dieldrin. The highest yield (2,592 lb. seed cotton per acre) was given by 1 lb. endrin with 0·25 lb. γ BHC per acre, but the profit was greatest for DDT alone at 1 lb. per acre, though the yield was only 2,232 lb. The cheapest treatment that gave a reasonable return was DDT alone at 0·25 lb. per acre. If DDT is used, γ BHC should be added to prevent possible outbreaks of *A. gossypii*. Endrin could be used alone, as it is effective against both the Aphid and the Lepidoptera. Eight applications at weekly intervals during the flowering period are probably sufficient.

Methods of application were compared on cotton sown on 17th February and treated eight times at weekly intervals from 13th May. The yields in lb. per acre were 635–665 for a dust of 3 per cent. BHC and 10 per cent. DDT applied with a hand-operated bellows duster or a rotary hand-duster at 10 lb. per acre, 1,222 and 1,616 for a spray of 1 lb. DDT with 0·25 lb. γ BHC per acre applied at low volume (6 gals. per acre) and at normal volume (100 gals. per acre), respectively, and 2,024 for the emulsion spray of DDT and γ BHC applied to run-off at about 300 gals. per acre. The yield for no treatment was 217 lb. per acre. The greater effectiveness of the high-volume sprays is offset by the excessive amounts of water required, and low-volume sprays are therefore recommended.

Goormans (C.) & Pujol (R.). **Recherches sur le charançon de la noix de kola,** *Balanogastris kolae* **(Desbr.).**—*J. Agric. trop. Bot. appl.* **2** no. 5–6 pp. 263–280, 8 figs., 24 refs. Paris, 1955.

Balanogastris kolae (Desbr.) is an important pest of *Cola* nuts in French West Africa, where the cultivation of this crop has increased in recent years, and as little was known of its bionomics, investigations were made in the laboratory, on material obtained from the Ivory Coast. The distribution and systematic position of the weevil are briefly reviewed, together with the literature on its bionomics, and the external differences between adults of the two sexes are discussed. Observations by the authors in French Guinea showed that development is continuous throughout the year, the trees flowering in March–April and August, the nuts being harvested in November–December and February, and development of the weevil continuing between December and February in fallen nuts and débris left after harvest.

In the laboratory, rearing was carried out at 28°C. [82·4°F.] in an almost saturated atmosphere, and fresh nuts were provided. The eggs were laid in holes pierced in the nuts, or in cracks already present, and hatched in about 4–12 days, with an average of 6·2 days. The larvae fed in the nuts

for 13–27 days, with an average of 17·4, and then constructed pupal chambers, usually near the surface. The pupal stage lasted 4–7 days, with an average of about five days, and the adults emerged after a further 2–3 days [*cf. R.A.E.*, A **26** 239]. Pairing and oviposition occurred immediately afterwards. An average of about 74 adult progeny was produced per female. The complete life-cycle lasted 19–47 days, with an average of about 29 days, and a negative correlation was found between the numbers developing in one nut and the length of the life-cycle. The adults survived for 12–104 days, under the normal conditions of rearing, but died within 23 days when kept at 10–12°C. [50–53·6°F.], and within four days when kept at a relative humidity of about 30 per cent., with fresh nuts but without water. When nuts of two varieties (white and red) were provided as food, there were no significant differences between the numbers of adults found on each. When the adults were given a choice between crushed cacao beans, a 1:1 mixture of crushed cacao beans and old crushed *Cola* nuts, a 1:1 mixture of crushed fresh *Cola* nuts and bran, and fresh crushed nuts of the red variety in petri dishes, most were attracted to the two last.

The destruction of damaged nuts both in the field and in storehouses is strongly urged, since they constitute foci of infestation and are readily used by *Balanogastris* for oviposition. Measures for the protection and disinfestation of the stored nuts are briefly reviewed, together with the natural enemies of the weevil. Many of the larvae and adults in nuts from the Ivory Coast had been killed by *Beauveria bassiana*.

Tooke (F. G. C.). **The Eucalyptus Snout-beetle, *Gonipterus scutellatus* Gyll. A Study of its Ecology and Control by biological Means.**—*Ent. Mem. Dep. Agric. S. Afr.* **3** [1+] iii + 282 pp., 150 figs., 15 graphs, 11 maps (4 fldg.), 1 fldg. table, 37 refs. Pretoria, 1955.

This detailed account of the bionomics and biological control of *Gonipterus scutellatus* Gylh. on *Eucalyptus* in South Africa is based on studies carried out in 1925–50, and much of the information in it has already been noticed [*cf. R.A.E.*, A **13** 38; **32** 355, etc.]. It is in two parts, of which the first deals with the identity of the weevil, its accidental introduction from Australia into South Africa, its spread there up to 1925, its life-cycle, food-plants and powers of dispersal, its seasonal cycle under various climatic conditions in Australia and South Africa and the effects exerted by various climatic factors, the damage caused to the trees, natural control agents in South Africa, and attempts at control by means of insecticides and cultural methods. The second part deals with biological control and contains accounts of the search for parasites of the weevil in Australia, the introduction of the Mymarid, *Anaphoidea nitens* Gir., a specific parasite of the eggs, into South Africa in 1926, its bionomics and morphology, the methods of mass rearing and liberation adopted, the releases made and the natural spread that occurred, its effect on *G. scutellatus* up to 1950, the factors that contributed to the control obtained, and a discussion of general aspects of the biological control of insects, with reference to the results of the campaign.

By 1950, *G. scutellatus* was under control in all the main *Eucalyptus*-growing areas on all species except the susceptible *E. viminalis*. In the Transvaal, control was erratic up to 1943, but then steadily improved and in many places was almost complete in 1949–50, even on *E. viminalis* and even where soil and climatic conditions were unfavourable; in some parts of the high veldt and elsewhere where soil conditions are poor or there had been prolonged drought, the parasite had not been successful, however. Effectiveness of the parasite showed a marked correlation with tree vigour,

which in turn depends on soil conditions and rainfall, and could be accelerated by more careful selection of suitable sites for plantations. The prospects for ultimate control are promising. The use of *E. viminalis* for the establishment of plantations should be discontinued, since this tree is likely to be severely damaged under adverse weather conditions, and existing plantations of it, especially if heavily damaged, should be replaced oy less susceptible species.

Frappa (C.). **Sur la présence de la maladie de Fidji dans les plantations de cannes à sucre de la côte est de Madagascar.**—*C.R. Acad. Agric. Fr.* **40** no. 15 pp. 560–563. Paris, 1954. **La maladie de Fidji dans les plantations de cannes à sucre de la côte est de Madagascar.**—*Bull. Madagascar* **4** no. 101 pp. 925–931, 4 figs. Tananarive, 1954. **Sur quelques observations biologiques effectuées à Brickaville sur** *Perkinsiella saccharicida* **Kirk., agent vecteur de la maladie de Fidji.**—*Op. cit.* **5** no. 108 pp. 437–443, 3 refs. 1955. **Sur un hyménoptère eulophide du genre** *Tetrastichus*, **nouveau parasite des oeufs de** *Perkinsiella saccharicida* **dans la région de Brickaville.**—repr. 3 pp., 3 refs. [*Sine loco*,? 1955.]

In the first of these papers, it is reported that sugar-cane in a plantation near Brickaville, on the east coast of Madagascar, was observed in April 1954 to be infected by Fiji disease, which had previously been unknown in the island. Other plantations in the east were subsequently found infected, and a total area of some 2,250 sq. miles was involved. The disease was not observed in the important sugar-growing areas of the north-west. The symptoms of the disease and investigations elsewhere on the transmission of the causal virus by *Perkinsiella saccharicida* Kirk. are reviewed [*cf. R.A.E.*, A **21** 520; **35** 368], and the bionomics of this Delphacid, which is present in Madagascar, are described. The virus is thought to have been introduced in 1942–44 with material from the Pacific islands or Australia. A variety of sugar-cane from Mauritius (M 134/32), which has been widely grown in Madagascar in recent years because of its high yield and resistance to mosaic disease, was found to be very susceptible to Fiji disease.

In view of the importance of preventing further spread of the disease either within Madagascar or to Mauritius and Réunion, in both of which *P. saccharicida* occurs, measures were instituted for its eradication. These included the removal of diseased canes and their burial or destruction by fire or chemicals, and the subsequent treatment of the foci with BHC dust against *Perkinsiella*. It was planned to investigate resistant varieties for possible introduction into Madagascar, to study the natural enemies of *Perkinsiella*, and to maintain disease-free nurseries for restocking the plantations.

The second paper is virtually identical with the first. In the third, it is stated that a field laboratory was set up to the south of Brickaville in September 1954, and the results are given of investigations during the first six months on the bionomics of *P. saccharicida*. The females laid 15–80 eggs each, usually 20–60, in 5–8 batches, and died 4–5 days later. There were usually six eggs per batch, but up to ten were observed. The egg and nymphal stages lasted 7–12 and 16–31 days, with averages of 9 and 18–20, respectively. The adults paired 3–12 days after emergence, and oviposition began 5–15 days later, with an average of 7–8 days. The adults survived for 12–28 days in captivity, and the complete life-cycle lasted about six weeks during the hot season. Related insects taken on sugar-cane at Brickaville comprised three species of *Fescennia* and one of *Cedusa*, and these Derbids were commoner during January 1955 than was *Perkinsiella*;

populations of the latter were estimated at about 2,800–4,800 per acre. The insecticides tested for application to foci of infestation after destruction of infected canes comprised a 25 per cent. BHC dust (3·5 per cent. γ isomer) at 6·3–9 lb. per acre, and a dust containing polychlorocyclohexane sulphide. Both gave about 95 per cent. mortality of *Perkinsiella* when applied from the ground, but almost complete control was afforded by dusting from a Piper Cub aeroplane.

It is stated in the fourth paper that an undescribed species of *Tetrastichus* was found parasitising the eggs of *Perkinsiella* in the laboratory near Brickaville, 136 adult parasites emerging from 700 egg batches collected in the field early in 1955. The characters of the genus are described, and a list is given of eight species of it recorded from Madagascar by J. Risbec.

Enoch (—). **La lutte contre la maladie de Fidji à Madagascar.**—*Rev. agric. Réunion* (N.S.) **55** pp. 160–168. Saint-Denis, 1955.

Barat (H.). **Problèmes sanitaires de la canne à sucre à Madagascar et en Australie.**—*Rev. agric. Maurice* **33** no. 5 pp. 207–218. Port Louis, 1954.

Orian (G.). **Fiji Disease of Sugar-cane in Madagascar. Report on a Mission.**—*T. c.* pp. 219–225, 2 pls., 1 ref.

In the first paper, an account is given of a visit in March 1955 to the sugar-cane areas of Madagascar affected by Fiji disease [*cf.* preceding abstract]. The phytosanitary measures adopted for the control of the disease there and those designed to prevent its spread to Mauritius and Réunion are discussed. These latter include the removal of sugar-cane growing near the main airports and thorough customs examination at ports, to prevent unauthorised dissemination of plant parts between the islands. Inspection of areas from which diseased canes had been removed some months previously, showed a large increase in the numbers of plants affected, and in view of the persistence of the disease, the suspension of sugar-cane growing for about a year or complete replanting with resistant varieties of cane is recommended.

The author of the second paper describes the discovery and discusses the origin of the outbreak of Fiji disease on sugar-cane in eastern Madagascar in 1954 [*cf.* preceding abstract] and reviews the difficulties of its control. He also discusses the production of sugar-cane in Australia, with special reference to Fiji disease and its control there [*cf. R.A.E.*, A **21** 520], and reports that the disease has been completely eliminated from several areas.

The third paper also comprises an account of a visit to the affected area in Madagascar and includes recommendations for measures to prevent the introduction of the disease into Mauritius.

Kelsey (J. M.). **Ragwort Seed-fly Establishment in New Zealand.**—*N.Z. J. Sci. Tech.* **36** (A) no. 6 pp. 605–607, 1 ref. Wellington, N.Z., 1955.

In further work on the biological control of ragwort (*Senecio jacobaea*) in New Zealand [*cf. R.A.E.*, A **31** 525, etc.], *Hylemyia seneciella* (Meade) was introduced from England and 36 adults were liberated in February 1937 in a small valley surrounded by woods, where conditions were favourable for establishment. The flower heads of *S. jacobaea* contain an average of 66 seeds each, and the larvae of the Anthomyiid feed on the developing seeds. Each larva attacks one flower head and destroys all but about 12 seeds, which, however, are usually found collapsed or distorted. In January 1938, 50–60 plants over an area about 100 yards square were attacked,

and by February 1950 the Anthomyiid was well established throughout the valley and had spread into adjoining ones; in the area most heavily attacked, which was about a mile long and half a mile wide, the infestation of the flower heads averaged 66 per cent. and the population of *H. seneciella* was estimated to be 4,526 million; late flowers, which are produced mainly on stunted and injured plants and represent some 12 per cent. of the total, were not attacked. Further spread had taken place by January 1954, when all stands of *S. jacobaea* were infested over an area of about ten square miles and laboratory examination of early and main-season flower heads showed that infestation amounted to over 98 per cent. as far as 2½ miles from the liberation site. Early flowers, comprising some 12 per cent. of the total, were in general most heavily attacked and late flowers were uninfested. It was found in tests that the seeds left in infested heads are unable to germinate; this may be due to various causes, including a mould that attacked infested flower heads. Limited data indicated a reduction from an average of 42 plants per 10-ft. square in 1950 to 34 in 1954. Although sufficient seeds are produced by the late flowers to reseed the area, *H. seneciella* shows promise as a control agent, and the valley under consideration might provide a source of material for more widespread liberations.

McDowall (F. H.), Patchell (M. R.), Hurst (F.) & Kelsey (J. M.). **Effect of Treatment of Dairy Pastures with BHC and DDT on the Flavour and Composition of Milk, Cream, and Butter.**—*N.Z. J. Sci. Tech.* **37** (A) no. 2 pp. 146–155, 25 refs. Wellington, N.Z., 1955.

Recent recommendations in New Zealand for the control of both *Costelytra zealandica* (White) and *Oxycanus* sp. in pastures include the broadcasting of p,p′DDT or γ BHC at 2 lb. per acre in superphosphate or lime. This treatment is best applied when the pasture in close-grazed and dry, and if this is not possible, grazing should not be permitted until rain has washed the insecticide on to the ground. Its use is at present mainly confined to pastures grazed by sheep, but as it will probably be extended to dairy pastures, its effect on the quality of dairy products was investigated during October–December 1952. The following is largely based on the authors' summary of the results. Treatment of dry, closely grazed pastures with dusts of γ BHC (as lindane) or wettable p,p′DDT at 2 lb. per acre in superphosphate, with an interval of three weeks before grazing by dairy cows, did not cause taint in the milk, cream or butter. As compared with treatment with superphosphate only, the butter contained 4–6 parts γ BHC per million and no p,p′DDT. Similar treatment with technical BHC, at 2 lb. γ isomer per acre, caused slight taint in the milk, cream and butter, and the BHC content of the butter, as compared with the control, was 16–18 p.p.m. When the pasture was tall and wet with dew, treatment at the same rates followed immediately by grazing caused tainting of the milk, cream and butter by both the BHC dusts and of the milk and cream by DDT, though the taint caused by DDT was not objectionable; in all cases, there was a rapid rise in the insecticide content of the butter. The taints from the BHC dusts persisted in the milk for several days after removal of the cows from the treated areas. As milk and cream delivered to factories is bulked during use, it is concluded that, provided the recommendations are strictly adhered to, there is no likelihood that factory-made cheese and butter will contain appreciable proportions of insecticide. Because of its lower tainting properties, DDT appears to be the most suitable insecticide for the treatment of dairy pastures.

Gurr (L.). **A Note on the Efficiency of *Bombus terrestris* (L.) as a Pollinator of Lucerne** (*Medicago sativa* **L.**).—*N.Z. J. Sci. Tech.* **37** (A) no. 4 p. 300, 2 refs. Wellington, N.Z., 1955.

Since some examples of *Bombus terrestris* (L.) visiting red clover (*Trifolium pratense*) for nectar in New Zealand bite through the corolla tube and do not trip the flowers, the introduction of this bumble bee has been considered unfortunate [*cf. R.A.E.*, A **44** 178]. In February 1954, however, bees of this species seen visiting lucerne invariably tripped the flowers, even when collecting nectar, whereas honey bees and a long-tongued bumble bee, *Bombus ruderatus* (F.), which were also freely visiting the flowers for nectar, did not trip any.

Cleland (J. W.). **Distribution and Control of Springtails in Cruciferous Crops and Pastures.**—*N.Z. J. Agric.* **91** no. 1 p. 13, 2 figs. Wellington. N.Z., 1955.

Serious damage to seedling crucifers similar to that usually attributed to adults of *Costelytra zealandica* (White) occurred in a district in the South Island of New Zealand in November–December 1953, as a result of which some crops were completely destroyed. *C. zealandica* was scarce at the time, and investigation showed that the damage was caused by Collembola, among which *Bourletiella hortensis* (Fitch), *B. arvalis* (Fitch) and *B. arvalis* subsp. *dorsobscura* Salmon were the commonest. The Collembola were widely distributed throughout Ashburton County and were found to cause significant injury to a wide variety of cruciferous crops. Populations ranged from 600 to over 900 per sq. ft., and as few as 20 per sq. ft. caused significant damage to germinating seedlings. Injury began as soon as the seed coat was shed, and large populations usually destroyed the cotyledons within 24 hours. The seedlings died if the cotyledons were lost before the fourth-leaf stage was reached, but only populations above 500 per sq. ft. caused noticeable damage to older plants, unless climatic conditions prevented rapid growth.

Experiments on control were carried out in a field sown with rape, turnip, and also short-rotation rye-grass [*Lolium perenne*] and clovers, in which the crucifers were being damaged. A spray of 0·5 lb. wettable γ BHC in 100 gals. water per acre, applied once or twice at an interval of a week, gave complete control, but was costly; similar treatments with DDT were ineffective.

Ghent (A. W.). **Oviposition Behaviour of the Jack-pine Sawfly, *Neodiprion americanus banksianae* Roh., as indicated by an Analysis of Egg Clusters.**—*Canad. Ent.* **87** no. 6 pp. 229–238, 4 figs., 3 refs. Ottawa, 1955.

Eggs of *Neodiprion banksianae* Rohw. are deposited in slits at more or less regular intervals along the edges of mature, current-year needles of jack pine [*Pinus banksiana*], each female requiring as many as 20–30 needles for full oviposition. An account is given of studies in Ontario on the sites selected by the females, made in connection with an investigation of gregarious feeding among the larvae, and the following is based almost entirely on the author's summary of the results. Egg clusters were situated with highly significant regularity towards the tip of the shoot. No preference was shown for either needle of a pair, and oviposition on the basal edges of the needles predominated. This resulted from a strong preference for the lower gravitational edge of the needle, the majority of jack-pine shoots being orientated

at angles above the horizontal. The number of eggs per infested needle showed a strong positive correlation with needle length, suggesting that the characteristic number (3–5) results from the limited variation in the length of jack-pine needles.

Boyce (H. R.). **Note on Injury to Tree Fruits by** *Frankliniella tritici* **(Fitch) (Thysanoptera: Thripidae).**—*Canad. Ent.* **87** no. 6 pp. 238–239, 2 figs., 2 refs. Ottawa, 1955.

Frankliniella tritici (Fitch) occurred in very large numbers on the flowers and leaves of sweet cherry, peach, plum and, to a less extent, apple and sour cherry in orchards in Ontario during the first three weeks of May 1954. On sweet cherry and plum, 30–50 per cent. of the flowers were destroyed, apparently as a result of the deposition of eggs in the flower stems, styles and ovaries, and many fruits were injured by the feeding of the nymphs and adults. On peach, eggs were laid freely beneath the epidermis of the stems and receptacles of the developing fruits, and as many as 35, often in groups, occurred in a single flower; a few of the flowers dropped as a result, but the injury was not of economic importance. This is the first instance of appreciable damage by *F. tritici* on fruit trees in Canada.

Phillips (J. H. H.). **Identity of a Cottony Scale on Peach in Ontario.**—*Canad. Ent.* **87** no. 6 p. 245, 1 ref. Ottawa, 1955.

Peach in the Niagara district of Ontario has over the past 30 years been severely attacked by a Coccid previously thought to be *Pulvinaria amygdali* Ckll. Steinweden showed it to be a different species, however [*cf. R.A.E.*, A **35** 321], and in 1949 he identified specimens as near *P. occidentalis* Ckll., which he had previously stated might be identical with the species known in Europe as *P. vitis* (L.) [**35** 322]. In 1954, Williams concluded from an examination of specimens from the Niagara Peninsula that there was little justification for separating the Coccid from *P. vitis* as known in Europe, and this view was confirmed by comparison of specimens from the Niagara Peninsula with others accepted as *P. vitis* from England and Germany. Limited food-plant studies indicated that the range of plants attacked by the Niagara Coccid, which has hitherto been reported only on peach and plum, may be wider than hitherto thought, and similar to that recorded for *P. vitis*.

Loschiavo (S. R.). **Rates of Oviposition of** *Tribolium confusum* **Duv. (Coleoptera: Tenebrionidae) surviving Exposure to Residues of** *p-p'*-**DDT.**—*Canad. Ent.* **87** no. 6 pp. 246–249, 1 graph, 5 refs. Ottawa, 1955.

The effect of sublethal concentrations of DDT on oviposition by females of *Tribolium confusum* Duv. was investigated in the laboratory. Equal numbers of males and females that had been separated as pupae and subsequently reared apart were confined together three weeks after emergence with a sufficient quantity of a food medium comprising 95 per cent. patent flour and 5 per cent. wheat germ to prevent crowding, preliminary tests having shown that the females laid significantly fewer eggs when less than 4 gm. per adult was available. They were kept at 32°C. [89·6°F.] and 75 per cent. relative humidity for a week, during which the mean daily oviposition rate was determined. The females were then isolated without food for 24 hours, since preliminary starvation had been shown to favour

uniform mortality, after which they were confined for two hours at 32°C. on deposits prepared by applying solutions of p,p′DDT at various concentrations in refined deodorised kerosene and acetone to glass plates at a rate of 1 ml. per 100 sq. cm. After exposure, they were kept with food for seven days at 32°C. and 75 per cent. relative humidity, and the survivors were then confined with equal numbers of untreated males under the same conditions for a further 19 days, during which egg counts were made every three days. The mean daily oviposition rate of females that survived exposure to the deposits from solutions of 10 or 25 per cent. DDT was found to be significantly reduced (from 11·5 to 7·7 eggs per female) over the observation period, whereas exposure to deposits from 1, 3 or 5 per cent. DDT had no significant effect. In a further test, females that had each been confined with a male and 8 gm. food for four days and had survived subsequent exposure for one hour to deposits from 5 per cent. p,p′DDT in benzene were each again isolated with an untreated male in the food medium, and their daily oviposition rate over a period of 12 days was determined. The rate was low on the first day after exposure, but then gradually increased until the fifth day, after which it remained fairly constant at a slightly, but significantly, lower level than that of untreated insects. In view of these results, the control of *T. confusum* given by DDT may be greater than appears from mortality data alone.

Ives (W. G. H.). **Effect of Moisture on the Selection of cocooning Sites by the Larch Sawfly,** *Pristiphora erichsonii* **(Hartig).**—*Canad. Ent.* **87** no. 7 pp. 301–311, 10 figs., 1 ref. Ottawa, 1955.

The ground surface in which larvae of *Pristiphora erichsonii* (Htg.) form their cocoons when they leave the larch trees on which they have fed is usually uneven and the moisture content of the moss in consequence variable. As the larvae in newly formed cocoons are readily killed by flooding [*cf. R.A.E.*, A **45** 110], the extent to which aggregation occurs in any particular region of a moisture gradient in the cocooning medium was investigated in Manitoba in 1951 and 1954. Four series of trays with screen bottoms were filled to a depth of 6 ins. with dried *Sphagnum* or other moss or with a 4-inch layer of one or other over a 2-inch layer of dried muck soil and set at a 15 per cent. slope on racks under a tarpaulin shelter in a shady part of a mixed spruce and larch bog. Each series consisted of three trays; five batches of 100 healthy larvae that had ceased feeding were evenly distributed over each tray at approximately daily intervals, and after a further five days the medium was cut into blocks and the number of cocoons in each determined. In 1951, two trays in each series were placed with their lower ends in pans of water, whereas the medium in the third was left dry. In 1954, two trays in each series were submerged until the moss was saturated and then drained, and each was enclosed in a plastic bag with a can of water to maintain high humidity; larvae were introduced into them a week later. The third tray in each series was divided longitudinally and placed with one end in water; one half was used for moisture determinations, and larvae were introduced into the other to provide a comparison with the results obtained in 1951.

The following is based almost entirely on the author's summary of the results. No cocoons were formed in soil, and dry moss was also unfavourable; larvae placed in it wandered considerably, and cocoons that were formed were poorly constructed. Larvae exposed to uniformly moist conditions constructed their cocoons near the surface, mostly in the upper 2 ins., and did not wander to any extent. The distribution of cocoons formed by larvae exposed to a moisture gradient showed that dry and very wet sites

were unfavourable. The favourable moisture ranges in *Sphagnum* and in other mosses were, respectively, 500–1,000 and 300–850 per cent. of the dry weight. No evidence suggested that the slope of the trays materially affected the choice of sites for cocoon formation, but there was some indication that the response to moisture may vary from year to year, since larvae in the dry sections appeared to respond to it less in 1954 than in 1951.

Reid (R. W.). **The Bark Beetle Complex associated with Lodgepole Pine Slash in Alberta. Part I.—Notes on the Biologies of some Scolytidae attacking Lodgepole Pine Slash.**—*Canad. Ent.* **87** no. 7 pp. 311–323, 12 figs., 14 refs. Ottawa, 1955.

Little is known of the bionomics and natural control of many of the Scolytids that attack lodgepole pine (*Pinus contorta* var. *latifolia*) or of the effect on the insects of different methods of logging. Sudden outbreaks in standing trees frequently result from breeding in slash remaining after logging operations, however, and studies on the insects that are associated with the slash were begun in 1952. The work was carried out in Alberta in a stand 84 years of age that was divided into nine 10-acre blocks, of which one was left as a control, and the trees in the others were felled according to different systems. The Scolytids found attacking the slash were *Ips perroti* Swaine, *I. pini* (Say), *I.* (*Pityogenes*) *knechteli* (Swaine), *Polygraphus rufipennis* (Kby.), and *I.* (*Orthotomicus*) *vicinus* (Lec.), which principally attacked fresh stumps and the lower stems of large standing trees. Other associated Scolytids were *Hylastes* (*Hylurgops*) *rugipennis* (Mannh.), which attacked the base of the stumps, just above the litter, *Dendroctonus valens* Lec., which was common in fresh stumps, and *I. guildi* Blkm., which was found in the lower stems but not in slash or stumps. Notes are included on the bionomics of most of these species.

Morris (R. F.). **The Development of sampling Techniques for Forest Insect Defoliators, with particular Reference to the Spruce Budworm.**—*Canad. J. Zool.* **33** no. 4 pp. 225–294, 3 pls., 8 graphs, 34 refs. Ottawa, 1955.

In this fourth paper of a series dealing with techniques for the study of natural populations of *Choristoneura fumiferana* (Clem.) in Canada [*cf. R.A.E.*, A **44** 159; **45** 7], the author discusses the problems that arise in the development of sampling techniques and illustrates the solutions offered by reference to observations on balsam fir (*Abies balsamea*) in north-western New Brunswick. The following is virtually the author's summary.

Insect populations may be expressed in different ways depending upon the objects of the sampling, and it is essential that these objects be carefully defined. In the studies on *C. fumiferana*, the preparation of life tables [**44** 159] is the primary objective, and population is expressed in terms of a basic unit (branch surface) and an absolute unit (the acre). The correct timing of sampling requires a knowledge of the insect's life history, and of the stability of the population in place and time. When insect remains, such as pupal cases and empty egg masses, are sampled, the retention factor gives rise to certain non-sampling errors. The mechanics of collecting foliage from tall trees is solved with the aid of aluminium pole pruners, extension ladders, tree trestles and platforms. The mechanics of counting the insects by ocular examination of the foliage samples also gives rise to non-sampling errors, which can be minimised by adequate supervision and by check examination.

The universe for which each life table is prepared is a homogeneous forest stand. It is shown that a collection unit smaller than a whole branch, or its longitudinal one-half, is unlikely to be suitable for the measurement of absolute population. Intertree variance is the major source of population variance for *C. fumiferana* and most other insects that have been studied intensively. Significant variance is also associated with crown levels, and the pattern of vertical distribution of *C. fumiferana* is not predictable. The criterion of representativeness can be satisfied, however, by drawing samples from four crown levels in such a way that the intensity of sampling is equal in each level. The design found suitable for *C. fumiferana* consists of proportionate sampling within the crown, stratified sampling by crown stories within the stand (with sub-strata, when necessary, according to food-plant species or flowering condition), and cluster sampling within strata. Samples may be drawn from the same trees during successive generations of *C. fumiferana*, and they show correlations that appear to arise from the preferences of ovipositing adults. The effect of the correlations on sampling design and analysis is discussed.

The relation between mean and variance indicates that population data are represented satisfactorily by the negative binomial distribution: variance may be stabilised and additivity provided through the use of logarithmic transformation. Methods of calculating optimum sample size are illustrated for both the original and the transformed data. The cost function for the sampling design used in the work on *C. fumiferana* is presented, and its use in the comparison of designs and the detection of limiting factors is demonstrated. The estimation of population per acre is achieved by means of regressions showing the relationships between foliage quantity, crown volume, and diameter of the trunk. Useful incidental data, including a measure of population intensity, and biological data for life tables, may be obtained during sampling. Also, the design can readily be modified to suit purposes of extensive insect survey or the biological assay of a single stimulus.

It is concluded that neither sampling nor non-sampling errors are likely to be prohibitive in work on populations of forest insects. The relative magnitude of sampling errors varies inversely with the population mean, however, and the preparation of complete life tables may not be practical at endemic population levels. In any one generation of the insect it is generally necessary to accept error limits that seem large in relation to those of laboratory experimentation. By the use of the same sampling plots over a period of years, replication is achieved in time as well as in place, so the formation of erroneous conclusions on epidemiological phenomena seems improbable.

Heimpel (A. M.). **Investigations of the Mode of Action of Strains of *Bacillus cereus* Fr. and Fr. pathogenic for the Larch Sawfly, *Pristiphora erichsonii* (Htg.).**—*Canad. J. Zool.* **33** no. 4 pp. 311–326, 5 pls., 29 refs. Ottawa, 1955.

Strains of *Bacillus cereus* pathogenic for the larvae of *Pristiphora erichsonii* (Htg.) have been isolated in Canada [*cf. R.A.E.*, A **43** 354], and it has been shown that this sawfly is also susceptible to strains of *B. cereus* from Lepidoptera and that other sawflies may be susceptible to it. An account is given of investigations on the way in which the bacterium affects the larvae of *P. erichsonii*, and the following is based on the author's summary of the results. There was a significant correlation between the pathogenicity of strains of *B. cereus* and the ability to produce lecithinase. Species of *Bacillus* that are incapable of producing lecithinase were not

pathogenic for the larvae. Histopathological evidence of toxaemia during the progress of infection by *B. cereus* is presented, and it is noted that the tissue degeneration is not of the type usually associated with proteolytic or lipolytic activity. About 3 μg. of a lecithinase preparation (containing about 21 mouse LD50's per mg.) was found to be the median lethal dose for the fifth-instar larvae. The main conclusion drawn from this evidence is that lecithinase plays an important part in the invasion and destruction of the larvae.

Church (N. S.). **Hormones and the Termination and Reinduction of Diapause in *Cephus cinctus* Nort. (Hymenoptera: Cephidae).**—*Canad. J. Zool.* **33** no. 5 pp. 339–369, 2 pls., 55 refs. Ottawa, 1955.

The following is virtually the author's abstract. It was shown by ligaturing, parabiotic experiments (in which two individuals were joined hind end to hind end so that their blood streams were confluent), and cytological studies that post-diapause morphogenesis in larvae of *Cephus cinctus* Nort. is initiated by a growth and differentiation hormone from the prothoracic glands [*cf. R.A.E.*, A **41** 327]. The prothoracic glands in turn are probably stimulated by a hormone from the protocerebral neurosecretory cells. The brain continues to influence the prothoracic glands even after they have begun to secrete, and the influence is more than that of a simple stimulation by the neurohormone. Furthermore, experiments with larvae reared apart from their cocoons suggested that the brain is to some extent influenced by environmental stimuli. If an effective amount of growth and differentiation hormone has not yet been secreted, exposure of a week or less at 35°C. [95°F.] causes postdiapause larvae to revert to diapause; exposure at 40°C. [104°F.] produces a much weaker effect [**45** 56]. The results of cytological examination suggested that exposure to 35°C. halts prothoracic gland activity and, meanwhile, permits the neurohormone to be dissipated. At the end of the heat treatment, there is insufficient neurohormone left to reactivate the prothoracic glands, which revert to dormancy.

Ives (W. G. H.). **Estimation of Egg Populations of the Larch Sawfly, *Pristiphora erichsonii* (Htg.).**—*Canad. J. Zool.* **33** no. 5 pp. 370–388, 2 graphs, 5 refs. Ottawa, 1955.

The following is virtually the author's abstract. The larch sawfly, *Pristiphora erichsonii* (Htg.), lays its eggs in the new terminal shoots of *Larix laricina*. The oviposition injury usually causes the shoots to curl. During 1952, a sampling project was conducted in a forest reserve in Manitoba to determine the feasibility of sampling the trees to obtain estimates of the egg population of the sawfly. Additional data on the frequency distribution of the number of eggs per shoot were collected in 1953 and 1954 from several areas in Manitoba and Saskatchewan. The number of eggs per curled tip varied between plots and between trees on one plot, but no factors contributing to variation could be found. The frequency distribution of the number of eggs per curled shoot was found to be a modified logarithmic normal distribution. The number of curled tips per branch and the number of branches per crown level varied between crown levels and between tree types. Stratification of the sample increased the efficiency of sampling, reducing the standard error of the mean by about 15 per cent. and the required sample size by about 30 per cent. The large variation in the estimated number of curled tips per tree indicates that a large sample of trees is required to obtain accurate estimates. As a

compromise between accuracy and practicability, it is recommended that six-branch samples be taken from each of at least 15 trees, using a stratified sampling with proportional allocation. Simple random sampling, taking two branches from the mid-crown of at least 25 trees, is suggested to provide a population index of sufficient accuracy for survey purposes.

Hobbs (G. A.) & Lilly (C. E.). **Factors affecting Efficiency of Honey Bees (Hymenoptera: Apidae) as Pollinators of Alfalfa in southern Alberta.** —*Canad. J. agric. Sci.* **35** no. 5 pp. 422–432, 1 pl., 22 refs. Ottawa, 1955.

The following is based on the authors' summary. In studies on the pollination of lucerne by honey bees in southern Alberta in 1951 and 1952, the bees preferred many other entomophilous plants to lucerne as sources of pollen. Although the experimental field was isolated from competing crops and other competing plants were appreciably reduced by spraying in both years, the honey bees did not gather pollen from lucerne until the preferred sources had ceased to flower; then it was so late in the season that few of the tripped flowers had time to produce mature seeds. Moreover, honey bees that were caged in lucerne plots for 33 days did not gather pollen from lucerne when released. Although accidental tripping of lucerne by nectar-collecting honey bees is a major factor in the commercial production of seed in Utah and California, it is a minor one in southern Alberta. The percentage of flowers tripped there is lower than at more southerly latitudes, probably because temperature and humidity conditions are not so conducive to automatic tripping; fewer honey bees use lucerne as a source of nectar because sweet clover (*Melilotus officinalis*) is prevalent in this region; there is less time for pollination of flowers and maturation of seed; and much of the tripping does not result in cross-pollination and hence fewer pods are formed per flower tripped and fewer seeds per pod. Conclusions drawn from data on seed yields will be erroneous if small populations of efficient native-bee pollinators [*cf. R.A.E.*, A **45** 57] are ignored where pollination activity of honey bees is low.

Chisholm (D.), MacPhee (A. W.) & MacEachern (C. R.). **Effects of repeated Applications of Pesticides to Soil.**—*Canad. J. agric. Sci.* **35** no. 5 pp. 433–439, 1 fig., 14 refs. Ottawa, 1955.

In view of the high toxicity of many recently developed insecticides and fungicides, the possibility that repeated applications of commonly used orchard sprays may result in the accumulation in the soil of residues harmful to plant growth was investigated in experimental plots in Nova Scotia in 1949–53. The materials tested included lead arsenate, DDT, parathion, sulphur, BHC and chlordane, and these were applied to the soil as suspensions in water and incorporated into it to a depth of about 6 ins. each year for 2–5 years in late May or early June before planting with beans, buckwheat, carrots, potatoes and onions. The amounts applied each year were estimated to be comparable with those that would be used in an average spray programme in a period of five years. It was found that applications of lead arsenate and DDT both caused a significant decrease in the yield of beans, and DDT also of buckwheat and onions; sulphur caused a significant reduction in the yield of all the crops, but the other insecticides had no consistent effect. DDT, arsenic (As), BHC and chlordane, but not parathion or sulphur, accumulated in the soil. BHC was found in potato tubers, carrots and onions grown in soil treated with it, and parathion in

buckwheat and the leaves and stems of beans, as well as on the surface of carrots and potato tubers. There was an increase in the content of arsenic in plants in plots treated with lead arsenate. Lead arsenate, sulphur and BHC significantly affected the chemical composition of the soil, and their continued use, especially at high rates, may be detrimental; the effect of BHC on the soil was due to its influence on soil organisms.

Pfadt (R. E.). **Control of Pale Western Cutworm in Wheat.**—*J. econ. Ent.* **49** no. 2 pp. 145–147, 3 refs. Menasha, Wis., 1956.

The following is based on the author's introduction and summary. An outbreak of *Agrotis orthogonia* Morr. occurred on winter wheat in south-eastern Wyoming in 1955, and endrin, dieldrin, DDD (TDE), heptachlor and toxaphene were tested in emulsion sprays for control of the larvae. Endrin, applied by ground machine at 0·2, 0·3 or 0·4 lb. in 15 U.S. gals. spray per acre on 4th May, when the larvae were mainly in the fifth and sixth instars, gave complete control, and 0·1 lb. endrin, 1 and 2 lb. DDD and 6 and 8 oz. dieldrin per acre were not significantly less effective, whereas 0·5 lb. heptachlor and 2 lb. toxaphene per acre were significantly inferior. Complete control was also obtained with 0·2 and 0·3 lb. endrin applied by aeroplane in 1 U.S. gal. spray per acre on 10th–12th May, but 0·2 lb. did not completely eradicate older larvae when applied on 29th–30th May.

Fukuto (T. R.), Wolf III (J. P.), Metcalf (R. L.) & March (R. B.). **Identification of the Sulfoxide and Sulfone Plant Metabolites of the Thiol Isomer of Systox.**—*J. econ. Ent.* **49** no. 2 pp. 147–151, 3 graphs, 6 refs. Menasha, Wis., 1956.

In this fifth paper of a series [*cf. R.A.E.*, A **44** 232, etc.], an account is given of further investigations on the chemical behaviour of O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate [demeton-S], one of the two isomers present in Systox [*cf.* **44** 230–232, etc.], in which the infra-red spectra of its metabolic products were compared with those of the synthetic oxidation products, in order to confirm the suspected identity of the metabolites [*cf.* **44** 232]. Demeton-S labelled with ^{32}P was applied to the bases of young cotton plants and its metabolites were recovered from the leaves and isolated by methods that are described. The results showed that the major metabolic product in the plant 4–6 days after application was identical with O,O-diethyl S-2-(ethylsulphinyl)ethyl phosphorothioate (the thiolphosphate sulphoxide). When this compound labelled with ^{32}P was applied to plants in the same way, the spectrum from the metabolite isolated after two weeks proved that subsequent oxidation to O,O-diethyl S-2-(ethylsulphonyl)ethyl phosphorothioate (the thiolphosphate sulphone) occurs at a somewhat slower rate than the conversion of demeton-S to the thiolphosphate sulphoxide.

Jefferson (R. N.) & Morishita (F. S.). **Azobenzene-Aramite and Azobenzene-Chlorobenzilate Sprays for resistant Spider Mites on Greenhouse Roses.**—*J. econ. Ent.* **49** no. 2 pp. 151–153, 7 refs. Menasha, Wis., 1956.

Azobenzene was formerly used, largely in vapour form, for the control of *Tetranychus telarius* (L.) in greenhouses in the United States [*cf. R.A.E.*, A **35** 180], but the vapour had the disadvantage of bleaching pink and red

roses, and azobenzene was therefore replaced by organic phosphorus insecticides. In southern California, the mite developed resistance to parathion and other phosphorus compounds in 1949, to Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] in 1952 and to Chlorobenzilate [ethyl 4,4′-dichlorobenzilate] in 1955, and experiments were therefore begun to ascertain whether azobenzene sprays [*cf.* **37** 381] would be effective against the mite on greenhouse roses.

In preliminary tests, 1·5 lb. 70 per cent. wettable azobenzene with 0·75 lb. 15 per cent. wettable Aramite or 25 per cent. wettable Chlorobenzilate per 100 U.S. gals. gave excellent control, provided that the coverage was good, whereas 3 lb. 70 per cent. azobenzene or 0·75 lb. each of 15 per cent. Aramite and 25 per cent. Chlorobenzilate per 100 U.S. gals. did not. In greenhouses in which sprays of Chlorobenzilate alone had given poor control in the spring, 3–5 applications of azobenzene with either Aramite or Chlorobenzilate between early July and early November gave very good control, and similar sprays also gave good results when applied commercially. Damage to the leaves was slight, and most of it was attributed to the Aramite or Chlorobenzilate. Little bleaching of the flowers was reported. The combined sprays killed all stages of the mite, apparently by contact action, but mortality was not complete for 4–5 days; no viable eggs appeared to be deposited in this period.

It is concluded that complete eradication of the mite in greenhouses can be obtained by very thorough application of these sprays, but that unless this is obtained, resistance will soon develop.

Rilett (R. O.) & Weigel (R. D.). **A Winter Survey of Coleoptera in Feed and Flour Mills.**—*J. econ. Ent.* **49** no. 2 pp. 154–156, 13 refs. Menasha, Wis., 1956.

Samples of whole grain, processed foods, floor sweepings, débris from corners and between floor boards and grain dust and flour from the machinery and other places were collected in 11 feed and flour mills at Buffalo, New York, between 12th October 1954 and 28th March 1955, and 2,632 beetles of 23 species were recovered from a total of about 27 lb. of sample material, indicating that the winter population in mills may be high. *Attagenus megatoma* (F.) (*piceus* (Ol.)) and *Oryzaephilus surinamensis* (L.) were each found in eight of the mills, and these and *Tenebroides mauritanicus* (L.) and *Tribolium confusum* Duv. were the most widely spread species. *T. confusum*, *A. megatoma*, *Gnathocerus cornutus* (F.), *Calandra* (*Sitophilus*) *oryzae* (L.) and *T. castaneum* (Hbst.), in order of abundance, constituted the bulk of the individuals collected; living examples of *O. surinamensis* were found at a temperature of 4°C. [39·2°F.] and of *Ptinus* and *T. confusum* at 11°C. [51·8°F.], but none of *C. granaria* (L.) or *C. oryzae* at less than 20°C. [68°F.]. *Cryptolestes minutus* (Ol.) (*Laemophloeus pusillus* (Schönh.)) and *C.* (*L.*) *ferrugineus* (Steph.) survived temperatures of 3°C. [37·4°F.] and probably less in a mill that had not been operated for four months. Exposure of a mill to outdoor temperatures of −5°F. for 48 hours, to test the possibility of exterminating insects by freezing, caused the air temperature inside to fall to 2°F., but that of accumulations of grain dust and débris did not fall below about 24°F., and some examples of *Tribolium*, *Tenebroides* and *Cryptolestes* were alive at the end of the exposure. One mill, in which all refuse had been removed every two weeks, contained practically no insects, and it is concluded that the elimination of potential breeding places throughout the year is an important part of any programme of insect control.

Glick (P. A.), Hollingsworth (J. P.) & Eitel (W. J.). **Further Studies on the Attraction of Pink Bollworm Moths to ultraviolet and visible Radiation.**—*J. econ. Ent.* **49** no. 2 pp. 158–161, 3 figs., 7 refs. Menasha, Wis., 1956.

The following is based largely on the authors' summary. Field studies on the attractiveness to *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) of traps containing lamps radiating in the ultraviolet and visible spectra were continued in Texas in 1954 [*cf. R.A.E.*, A **44** 120, etc.]. When two traps equipped with ultraviolet fluorescent lamps, one with and one without a motor-driven suction fan in operation, were operated 10 ft. apart from 7th to 20th August, 76 per cent. of the moths collected were found in the former. Traps equipped with three 2-watt argon bulbs (essentially ultraviolet lamps of low intensity) captured relatively more adults of *P. gossypiella* than other insects and a higher proportion of females than those with ultraviolet fluorescent or ultraviolet-blue fluorescent lamps. An electrocuter-grid trap equipped with two ultraviolet fluorescent lamps, operated continuously from 18th April to 15th July in a plot of cotton one-twentieth of an acre in extent and covered with a cage, in which adults were liberated, did not prevent infestation of all the cotton bolls, though numerous adults were killed by it. Hourly counts from 8 p.m. to 6 a.m. on dark nights showed that 40 per cent. of the moths taken entered the traps between 2 a.m. and 4 a.m. and that females outnumbered males only between 11 p.m. and 1 a.m., and when the traps were operated at heights of 2–14 ft. above the ground and 17 ft. apart at the edge of a cotton field, 39 per cent. of the moths taken were caught at the 2 ft. level and 71 per cent. at heights up to 6 ft. Catches in traps facing in opposite directions showed that 86 per cent. of the moths flew into the prevailing wind. In both 1953 and 1954, more moths were taken in August than in July or September in traps fitted with ultraviolet fluorescent or mercury-vapour lamps and operated at various places in the Lower Rio Grande Valley; the numbers of moths taken were correlated with infestation of cotton in the field and crop maturity.

App (B. A.). **Control of the Clover Root Borer and the Meadow Spittlebug on Red Clover.**—*J. econ. Ent.* **49** no. 2 pp. 161–164, 3 refs. Menasha, Wis., 1956.

The following is based largely on the author's summary. *Hylastes* (*Hylastinus*) *obscurus* (Marsham) and *Philaenus leucophthalmus* (L.) are two of the most important insect pests of red clover in the United States. Treatments for control of the former were applied in tests carried out in Ohio from September 1949 to May 1952, and observations were also made on their effects on *Philaenus*, to discover whether a single treatment could be used against both. Of the ten organic insecticides tested, aldrin, BHC and heptachlor were the most promising against *Hylastes*. Heptachlor, applied at 1·5–1·75 lb. per acre in a dust in spring, reduced the population by 97–100 per cent., whereas comparable dosages in emulsion sprays gave inadequate control. Aldrin dusts at the same rates reduced the population by 61–98 per cent. when applied in autumn and by 83–99 per cent. when applied in spring. Lower doses and, with one exception, emulsion sprays of aldrin were unsatisfactory, but 1 lb. aldrin per acre was as effective in a wettable-powder spray as in a dust. BHC reduced the population by 37 and 72 per cent. when applied in autumn at 1 and 1·25 lb. γ isomer per acre, respectively, and by 13–89 per cent. when applied in spring at 0·75–2 lb. It gave fair control when applied in a wettable-powder spray in May 1950, but poor results in emulsion sprays in May 1951 and 1952. Heptachlor, aldrin and

BHC in dusts and sprays controlled the nymphs of *Philaenus*, as also did most of the other insecticides tested.

Klostermeyer (E. C.), Landis (B. J.), Schoop (R.) & Butler (L. I.). **Effect of Systemic Insecticides on Green Peach Aphid Populations on Potatoes.**—*J. econ. Ent.* **49** no. 2 pp. 164–166, 5 refs. Menasha, Wis., 1956.

Myzus persicae (Sulz.), the principal insect vector of potato leaf-roll in Washington [*cf. R.A.E.*, A **44** 281], was for several years controlled by a dust of DDT, parathion and sulphur [*cf.* **44** 282], but has recently become increasingly difficult to kill. Emulsion sprays containing systemic insecticides were tested in 1954, demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] at 3, 6 and 12 oz., schradan at 1 and 2 lb., parathion at 12 oz. and Isolan [1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate] at 4 oz. in 25 U.S. gals. spray per acre being applied on 16th June and again on 12th July. The Aphid population developed slowly in June, and the first application had little effect, but daily reinfestation by alates, with a resultant increase in apterae, occurred in mid-July. All materials reduced populations for three days after the second application, and demeton at the higher rates and schradan remained effective for a fortnight, whereas the other treatments lost most of their toxicity in a week. A further treatment on 26th July with demeton, schradan and parathion at the same rates and Isolan at 8 oz. per acre gave similar results. Schradan and demeton remained moderately effective for two weeks at 1 lb. and 6 oz. per acre, respectively, and for three at 2 lb. and 12 oz.

Appreciable numbers of tubers from all plots showed symptoms of leaf-roll infection soon after harvest, in September, and still more did so after winter storage, with no differences due to treatments, and it was evident that winged Aphids were not killed rapidly enough or in sufficient numbers to prevent the transmission of the virus. Small amounts of demeton and schradan were translocated to the tubers, which were found to contain up to 0·38 and 0·59 parts per million, respectively, at harvest, but rats and monkeys that fed on them were not adversely affected.

Bishopp (F. C.). **Insects lower the Quality of Cotton Lint and Seed.**—*J. econ. Ent.* **49** no. 2 pp. 172–175, 5 refs. Menasha, Wis., 1956.

Insects have long been known to reduce the yield of cotton, but less attention has been paid to the reduction in quality that results from infestation. The author reviews the principal pests of the crop in the United States and shows how attack by those that infest it after the bolls are set affects the quality of the lint and seed, either by direct attack or by so defoliating the plants as to prevent normal maturation of the bolls. The main pest dealt with is the pink bollworm [*Platyedra gossypiella* (Saund.)], which reduced the grade of the lint and the weight of the seed in Texas in 1952, when infestation was heavier than in previous years, and again in 1954, when the amount of staining was found to increase with the infestation level and there were also marked reductions in fineness, maturity and yarn strength due to heavy infestation. Lint quality is also reduced by contamination with the honeydew excreted by the cotton Aphid [*Aphis gossypii* Glov.], by the staining caused by the excreta of the cotton leaf-worm [*Alabama argillacea* (Hb.)], by heavy infestation by *Bucculatrix thurberiella* Busck, and by disease organisms introduced into the bolls by plant-feeding bugs. *P. gossypiella* has recently been shown to introduce a

fungus into the bolls that it attacks. Stored cottonseed is infested by the usual pests of stored products [*cf. R.A.E.*, A **29** 467], including the recently introduced *Trogoderma granarium* Everts [*cf.* **44** 445], which has been found in broken seeds and cottonseed meal.

Clausen (C. P.). **Biological Control of Fruit Flies.**—*J. econ. Ent.* **49** no. 2 pp. 176–178, 9 refs. Menasha, Wis., 1956.

The control of fruit-flies by the introduction of natural enemies has achieved its greatest degree of success in Hawaii, where it has received special attention because of the occurrence of three of the most important of these pests. The search for natural enemies of *Ceratitis capitata* (Wied.) began in 1912 [*cf. R.A.E.*, A **2** 316] and resulted in the establishment of three species of *Opius* that parasitise the larvae and of two pupal parasites of less importance [*cf.* **6** 185; **26** 84]. Investigation of the natural enemies of *Dacus cucurbitae* Coq. began in 1915 and resulted in the establishment of *Opius fletcheri* Silv. [*cf.* **4** 474; **19** 224], which is still common but has little effect, parasitism being low in summer. *O. angaleti* Fullaway (a species from North Borneo) and *O. watersi* Fullaway, which were imported in 1950–51 [*cf.* **40** 236], failed to become established. Investigations on the enemies of *D. dorsalis* Hend. were begun in 1948, and introduced parasites have resulted in substantial reductions in this fruit-fly in most of the islands of the group [*cf.* **40** 83, 173]. Attempts at biological control of *Dacus* spp. in other countries [*cf.* **25** 588; **26** 359, 702], of *Anastrepha* spp. in Central and South America and the West Indies [*cf.* **30** 303] and of *Rhagoletis* spp. in the United States [*cf.* **22** 355] are shown to have been much less successful, and it is concluded that although introductions of polyphagous pupal parasites have proved useful, there has been consistent failure with the more important species of *Opius*, probably because the numbers released were too small or because the parasites were not adapted to the hosts against which they were liberated. It is doubtful whether a species of tropical or subtropical origin that normally develops in a host having several generations a year can adapt itself to one having only one generation a year in a temperate area; the author discusses in this connection the origin of the *Opius* species most successfully used against fruit-flies in Hawaii.

Burrage (R. H.) & Gyrisco (G. G.). **The Transformation of Counts of European Chafer Larvae for Analysis of Variance.**—*J. econ. Ent.* **49** no. 2 pp. 179–182, 1 graph, 7 refs. Menasha, Wis., 1956.

Investigations were carried out in New York in 1951 to determine the relation between the mean and variance of counts of larvae of *Amphimallon majalis* (Razoum.) in experimental plots in permanent pasture and to determine the effect of a square-root transformation of the counts on this relation. The variance of the counts was linearly related to the mean, but this correlation became insignificant when each original value (x) was transformed to $\sqrt{x + \frac{1}{2}}$, and this transformation should be used in analyses of variance of larval counts in the observed range of population density.

Refai (F. Y.), Miller (B. S.), Jones (E. T.) & Wolfe (J. E.). **The Feeding Mechanism of Hessian Fly Larvae.**—*J. econ. Ent.* **49** no. 2 pp. 182–184, 3 figs., 6 refs. Menasha, Wis., 1956.

Feeding by *Mayetiola* (*Phytophaga*) *destructor* (Say) on wheat results in no visible damage to the stem under the head or body of the larva, and its

mechanism was hitherto unknown [*cf. R.A.E.*, A **18** 476]. Observations are recorded showing that it consists of an intermittent sucking action.

March (R. B.), Fukuto (T. R.), Metcalf (R. L.) & Maxon (M. G.). **Fate of P^{32}-labeled Malathion in the Laying Hen, White Mouse, and American Cockroach.**—*J. econ. Ent.* **49** no. 2 pp. 185–195, 1 fig., 13 refs. Menasha, Wis., 1956.

It is concluded from experiments noticed elsewhere [*R.A.E.*, B **45** 76] that the metabolism of malathion in warm-blooded animals is complex, probably involving progressive hydrolysis of the ethyl ester moieties of the molecule to produce more ionic and water-soluble compounds, which apparently exhibit a low order of toxicity. It probably involves, as well, the oxidation of the thiono-sulphur moiety to produce a series of phosphorothiolates. One of these may be O,O-dimethyl S-1,2-di(ethoxycarbony!)ethyl phosphorothiolate, a compound that was markedly more toxic than malathion to various arthropods and showed greater inhibition of cholinesterase of the house-fly (*Musca domestica* L.). The metabolism of malathion in cockroaches (*Periplaneta americana* (L.)) is apparently less extensive and complex than it is in warm-blooded animals. The less effective metabolism in the insect may explain why malathion is much more toxic to insects than to warm-blooded animals, in which most of the rapidly formed metabolites are apparently of a low order of toxicity.

Clancy (D. W.) & McAlister (H. J.). **Selective Pesticides as Aids to biological Control of Apple Pests.**—*J. econ. Ent.* **49** no. 2 pp. 196–202, 4 graphs, 12 refs. Menasha, Wis., 1956.

The following is based largely on the authors' summary. Investigations were begun in West Virginia in 1952 on the effects of spray ingredients on arthropod pests of apple and their natural enemies, with a view to obtaining better coordination of chemical with biological control. Initial tests were made in a recently abandoned orchard, in which natural enemies were more numerous than in sprayed orchards, and the most promising materials were compared with standard sprays in complete seasonal schedules in three commercial orchards.

Two fungicides, glyodin [2-heptadecyl glyoxalidine acetate] and captan [N-trichloromethyl thiotetrahydrophthalimide], used at standard rates, were found to be relatively harmless to predacious mites of the genus *Typhlodromus*, including *T. pomi* (Parrott) and *T. fallacis* (Garman), which are the main predators of *Metatetranychus ulmi* (Koch) on unsprayed trees, but sulphur sprays were highly toxic to them. Glyodin showed evidence of toxicity to *M. ulmi* early in the season. When DDT was used alone or in standard schedules in the abandoned orchard, *Typhlodromus* spp. were virtually eliminated and infestation by *M. ulmi* became much greater than on trees receiving any other treatment, though *Stethorus punctum* (Lec.), its second most important predator, was little affected. DDT was very effective against *Cydia* (*Carpocapsa*) *pomonella* (L.) in the commercial orchards, but its failure during three seasons in the abandoned one suggested that the population there might have acquired partial resistance to it.

A mixture of glyodin with ryania at 4–6 lb. per 100 U.S. gals. gave outstanding control of heavy infestations of *C. pomonella*, comparable with that usually obtained with DDT, in both the abandoned and the commercial orchards, but control was less satisfactory when captan was substituted for glyodin. Ryania appeared to be effective against *Empoasca maligna*

Walsh and *Bryobia praetiosa* Koch, but of limited value against *Eulia* (*Argyrotaenia*) *velutinana* (Wlk.) and *Conotrachelus nenuphar* (Hbst.). *Typhlodromus* spp. were not harmed by pure ryania, but were seriously affected by repeated sprays of activated ryania, which contains 3·2 per cent. propyl isome [di-n-propyl 6,7-methylenedioxy-3-methyl-1,2,3,4-tetrahydronaphthalene-1,2-dicarboxylate] and by the addition of lead arsenate to pure ryania. This is, however, necessary against *Eulia* and *Conotrachelus* early in the season, and the mites recovered sufficiently after early sprays to be effective during the summer.

The abundance of predators and comparatively low infestation by *M. ulmi* in plots sprayed with glyodin and pure ryania indicate that this combination of toxicants may have a promising selective effect in promoting the biological control of Tetranychid mites. Populations of *Typhlodromus* showed encouraging increases in several plots treated with pure ryania in the commercial orchards, and continued improvement is expected if the use of harmful materials can be avoided.

Janvier (H.). **Hymenopterous Predators as Biological Control Agents.**—*J. econ. Ent.* **49** no. 2 pp. 202–205, 2 refs. Menasha, Wis., 1956.

The author discusses, with examples drawn from his experience in France and Chile, the conditions that favour the establishment of nest-building predacious Hymenoptera, which attack many injurious species of insects, and of solitary bees, which are valuable pollinators. He states that in parts of France in which the hedgerows round small fields are trimmed by hand every year, the cut ends remaining on the plants are used by bees and predacious Hymenoptera for nest-building, and that where the hedges have been replaced by wire, insect damage to the crops constantly increases, necessitating the use of more insecticide each year. Species that nest in earth or sand are favoured by the construction of ditches with almost vertical banks or the placing of sand piles. In view of the damage caused to crops by insects, experiments should be carried out to determine the value of conserving some of the native flora and fauna in order to provide a more suitable environment for beneficial insects.

Davis (J. M.) & Nagel (R. H.). **A Technique for Tagging large Numbers of live adult Insects with Radioisotopes.**—*J. econ. Ent.* **49** no. 2 pp. 210–211, 2 figs., 1 ref. Menasha, Wis., 1956.

If a radioisotope is to be applied to hiding or burrowing insects as a means of tracing them, one that emits γ rays should be selected, because of the penetration required, and as relatively large amounts of it may be needed for rapid determination at convenient distances, it should possess a high specific activity, in order to reduce the weight of material on the insect. The authors describe a technique developed to apply about 20 microcuries each to forest Coleoptera so that they could be rapidly detected when hidden under the bark of trees or under débris on the ground. Sodium iodide, scandium chloride and sodium chloro-iridate, containing ^{131}I, ^{46}Sc and ^{192}Ir, respectively, were successfully used, but silver nitrate, containing ^{110}Ag, and rubidium chloride, containing ^{86}Rb, were toxic in the amounts necessary. The beetles were submerged in the isotope solution in an apparatus described, 20 per cent. ethanol being added as wetting agent, and were then put to dry on water-repellent trays. Treated beetles of several species, including the Engelmann spruce beetle [*Dendroctonus engelmanni* Hopk.], did not differ in behaviour from untreated ones under laboratory conditions.

About 19,000 adults of *D. engelmanni* were tagged with ^{131}I in Colorado, in batches of about 1,000, and about 85 per cent. of them survived and were released. Treated beetles were fairly easily detected under the bark of trees with portable scintillation counters for about two weeks after treatment, by which time the radioactivity of the isotope had fallen to about a fourth of its original value, and about 5 per cent. were later redetected. A few treated beetles that were examined by peeling the bark from over them appeared to be making typical galleries and laying eggs normally, indicating that the treatment had little adverse effect.

Siakotos (A. N.). **Contamination of Food and Air by Lindane Vapor.**—*J. econ. Ent.* **49** no. 2 pp. 212–214, 6 refs. Menasha, Wis., 1956.

An account is given of experiments in which packaged or unpackaged food stored in rooms that had been treated with γ BHC (lindane) was contaminated by the vapours from the BHC deposits. The food used was shredded wheat, which was selected because its surface area is high and it is relatively free from solvent matter. The BHC was applied in comparable amounts by fumigation (vaporisation), by spraying surfaces with an emulsified solution, and by painting surfaces with a solution in oil. The food samples and air were analysed for BHC after the samples had been stored in the rooms for two hours including the treatment period, or for 26 hours, 1 week or 2 weeks beginning after treatment was completed. The fumigated rooms were aired for 30 minutes at the end of two hours, but the other rooms were kept closed.

The amounts of BHC in air and food samples both decreased with time, and those in the air were highest in the fumigated rooms and lowest in that treated with the oil solution. Contamination of the food samples during treatment was greatest in the fumigated rooms, but post-treatment contamination was greatest in the room treated with oil solution. It is thought that the application of BHC in oil may lead to a more cumulative contamination than the other methods through the solvent effect of the oil, which also vaporises, in a food that is practically without solvent material.

The concentrations of BHC in air indicated that the rate of volatilisation was greatest for the deposit applied by fumigation and least for that applied in oil solution. Higher vapour concentrations led to higher food sorption, and a decrease in vapour concentration to a reduction in the amount of BHC sorbed. This reduction was probably due to revaporisation of some of the initially adsorbed BHC and to reduced adsorption. If the product had an appreciable fat content, absorption might also be concerned in the complex.

Hough (W. S.) & Hill (C. H.). **Outbreak of a Leaf Miner on Apple and its Control.**—*J. econ. Ent.* **49** no. 2 pp. 217–219, 3 refs. Menasha, Wis., 1956.

An outbreak of *Parornix* (*Callisto*) *geminatella* (Pack.) occurred on apple in northern Virginia in 1954 and 1955 and spread to West Virginia, Maryland and Delaware in the second year. Investigations on the seasonal history of this leaf-miner [*cf. R.A.E.*, A **4** 343] in Virginia showed that nearly all the adults of the overwintering generation emerged between the time when the apple buds first showed green and full bloom and that there were at least four generations a year. In tests on control, sprays of 1·5 lb. 15 per cent. parathion, 2 lb. 25 per cent. malathion, 10 per cent. γ BHC or 50 per cent.

DDT, 0·5 lb. 50 per cent. dieldrin, 1 U.S. quart 25 per cent. DDD (TDE) or 0·75 U.S. pint nicotine sulphate per 100 U.S. gals. gave complete kill of the adults within 24 hours when applied in August 1954. When applied against the larvae in their mines, 1·5 lb. 15 per cent. parathion per 100 U.S. gals. gave complete kill of young larvae in September 1954, and 0·75 lb. was very effective against older ones in July 1955; 0·75–1 U.S. pint nicotine sulphate was effective against the former, but not the latter, and 1 U.S. pint Systox [diethyl 2-(ethylthio)ethyl phosphorothioate (demeton)] or Am. Cyanamid 3911 [O,O-diethyl S-ethylthiomethyl phosphorodithioate] per 100 U.S. gals. both gave 87 per cent. control in 1955, whereas malathion was relatively ineffective and DDT and DDD, alone or together, BHC, dieldrin, ryania and Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] were even more so. In early August, when many of the larvae had spun their cocoons, 2 lb. 15 per cent. parathion, 1 U.S. pint Systox and 2·5 lb. 25 per cent. malathion per 100 U.S. gals. reduced adult emergence by 92, 76 and 51 per cent., respectively; dead parasites were found in 26 and 19 per cent. of the cocoons sprayed with the last two compounds and in 21 per cent. of untreated ones.

Experience showed that insecticides effective against the adults alone did not give control when limited to cover sprays. Parathion was the best of those effective against the adult, leaf-mining and cocoon stages, and it would probably give satisfactory control if applied once when foliage injury becomes evident.

Dorsey (C. K.) & Leach (J. G.). **The Bionomics of certain Insects associated with Oak Wilt with particular Reference to the Nitidulidae.**—*J. econ. Ent.* **49** no. 2 pp. 219–230, 10 figs., 28 refs. Menasha, Wis., 1956.

The following is based largely on the authors' summary. Investigations begun in West Virginia in 1952 on the relation of insects to the spread of *Endoconidiophora fagacearum*, the fungus that causes oak wilt [*cf. R.A.E.*, A **42** 99], showed that Nitidulids were the most numerous of the insects attracted to fresh tree wounds and to the mycelial mats of *E. fagacearum* in oak trees dying from the disease, *Carpophilus lugubris* Murr. and *Colopterus semitectus* (Say) being the commonest, and the bionomics of these and other insects associated with the fungus were studied in 1952–54. Counts of Nitidulids taken in traps on the trees showed that they preferred baits prepared from *E. fagacearum* or other fungi to artificial ones. Nitidulids of five genera and 17 species were taken in the traps, but *Glischrochilus sanguinolentus* (Ol.), *G. fasciatus* (Ol.), *G. confluentus* (Say) and *Cryptarcha ampla* Er. constituted more than 80 per cent. of the total in two successive years. Nitidulids were present throughout the year, *G. confluentus* being the only one that was readily collected in January–March and *G. fasciatus*, *G. sanguinolentus* and *C. ampla* becoming numerous in early April, late April and the beginning of May, respectively. Populations were greatest in early spring and autumn, when the mean weekly temperature was approximately 50°F.

The bionomics of *Colopterus semitectus* were studied in some detail, and those of several other species were found to be similar. The life-cycle was comparatively short (21–25 days) under optimum conditions, and there were at least three generations a year. Eggs were deposited under the bark in moist wounds, which consistently became overgrown with fungi, and also on the mycelial mats of *E. fagacearum*. The larvae hatched in three days, fed on the fungi and, apparently, pupated among débris on the ground.

Overwintering occurred mainly in the adult stage, but some species possibly overwinter as larvae or pupae in the soil or débris.

The relation between the Nitidulids and the fungi with which they are associated is apparently one of mutual symbiosis. *E. fagacearum* is a new member of the complex in West Virginia, and it probably depends on the beetles for dissemination to fresh wounds. In the absence of effective control measures, the disease is likely to spread. The Nitidulids are effective vectors because of their feeding and breeding habits, high reproductive potential, flight and dispersal characteristics, quick response to stimuli and prevalence during all seasons of the year, but spread is slow because of the requirement of fresh wounds for effective inoculation and the short period for which a wound remains in a suitable condition.

Ball (H. J.). **Effect of Insecticides on Corn Root Growth.**—*J. econ. Ent.* **49** no. 2 pp. 230–233, 1 fig., 9 refs. Menasha, Wis., 1956.

In tests of their phytotoxicity to maize, aldrin, BHC and heptachlor were added in emulsifiable concentrates at rates equivalent to 0·5 and 1 lb. per acre to nutrient solutions in which seedlings were allowed to grow for 48 days and to sand in which the seeds were germinated and the seedlings allowed to grow for a week. BHC caused severe reductions in plant growth, with shortened and enlarged primary roots and a considerable decrease in the number of secondary roots and root hairs, whereas heptachlor and aldrin had little effect. When the insecticides were applied to soil at 0·5, 1 and 2 lb. per acre, BHC had less effect, but aldrin caused slight decreases in root length at rates of 1–2 lb. per acre, whereas heptachlor increased it in some plots. No insecticide at 0·5–1 lb. per acre reduced germination in sand or soil. In field tests in Nebraska in 1954, heptachlor increased root length and plant weight in comparison with untreated plots and those treated with aldrin or BHC; BHC resulted in slightly shorter roots than aldrin. Exploratory tests indicated that total BHC caused more injury than γ BHC, possibly owing to the presence of the δ isomer [*cf. R.A.E.*, A **40** 165].

Kirk (V. M.). **Control of Billbugs on Corn in South Carolina.**—*J. econ. Ent.* **49** no. 2 pp. 233–236, 4 refs. Menasha, Wis., 1956.

Sphenophorus (*Calendra*) *maidis* Chitt. and *S.* (*C.*) *callosus* (Ol.) cause more loss of maize plants in the south-eastern United States than any other insect. The overwintered weevils leave the stubble of the previous crop over a period of 2–3 weeks from about the time when most maize begins to appear above ground, and feed at the base of the stems, causing the plants to produce unproductive suckers, weakening them so that they produce no ears, and killing many of them. Oviposition begins about ten days later, and the females lay about 200 eggs each, singly in slits in the stem. The larvae feed in the centre of the stem at about ground level and reduce the vitality and yield of the plant. They pupate in the tap root during August, and newly emerged adults may be found in the base of the stem by mid-September in South Carolina, most of them remaining there until the spring [*cf. R.A.E.*, A **18** 217; **22** 696].

In tests on the control of *S. maidis*, surface applications of various organic insecticides at or after adult emergence caused some mortality, but not enough to save the stand, and the effect of residual insecticides mixed with the soil just before sowing was therefore tested in the insectary and field

cages. When applied at 2 lb. per acre, aldrin gave the highest kills and heptachlor was almost as effective, but dieldrin and chlordane were relatively useless; wettable powders were superior and granules inferior to dusts. Treatment of three heavily infested fields with 5 lb. 40 per cent. wettable aldrin mixed with 95 lb. fertiliser per acre, broadcast over the ploughed soil and immediately disked in on 19th March, a week before the maize was sown, resulted in virtual eradication in two and excellent control in the third, whereas there was 51–62 per cent. loss of stand in neighbouring untreated fields. *S. callosus* was found to be about as susceptible to insecticides as *S. maidis*.

Early (J. D.) & Cochran (J. H.). **Insecticidal Evaluation of organic arsenical Compounds.**—*J. econ. Ent.* **49** no. 2 pp. 239–242, 13 refs. Menasha, Wis., 1956.

An account is given of tests in which 39 organic arsenical compounds were compared with standard insecticides for toxicity to adults of *Anthonomus grandis* Boh. and *Calandra* (*Sitophilus*) *oryzae* (L.) and larvae of *Alabama argillacea* (Hb.) and *Laphygma* (*Prodenia*) *eridania* (Cram.). Each compound was diluted to make a 20 per cent. dust and applied to cotton plants for tests against *Anthonomus* and *Alabama*, to maize kernels for *Calandra* and to sections of leaves for *Laphygma*; mortality counts were made after 72, 120 and 48 hours, respectively, on the treated material. Arsenomethane As-1,2-disulphide, its camphorated derivative, chloro- and dichloroarsenomethane As-1,2-disulphide, and arsonated toxaphene gave practically complete mortality of all but *Anthonomus*, and were the best of the compounds tested, being comparable with 10 per cent. DDT, 20 per cent. toxaphene and 3 per cent. γ BHC; they gave 42, 19, 100, 19 and 62 per cent. mortality of *Anthonomus*, and arsonated toxaphene appeared to be more toxic than toxaphene itself.

In tests of phytotoxicity, 1–10 per cent. dusts of arsenomethane As-1,2-disulphide in pyrophyllite caused no damage to young cotton plants, whereas 25 and 50 per cent. dusts caused slight or severe injury in 48 hours under humid conditions, and this compound and chloroarsenomethane As-1,2-disulphide, diluted with plant nutrient solution and supplied to cotton seedlings for a week, injured most or all of them beyond recovery at concentrations of 1:1,000, but caused little or no injury at 1:100,000.

Wilcox (J.) & Howland (A. F.). **Experiments on the Control of the Two-spotted Spider Mite on Strawberries.**—*J. econ. Ent.* **49** no. 2 pp. 242–244. Menasha, Wis., 1956.

Tetranychus telarius (L.) is the most important pest of strawberry in southern California. Emulsion sprays and dusts were therefore tested against it in 1951–54, applications being made as needed, usually from April to July. Good results were given in several years by sprays of 3 lb. demeton [diethyl 2-(ethylthio)ethyl phosphorothioate] in 20 U.S. gals. spray, applied at 4·7–6·9 U.S. gals. per acre, and by dusts of 10 per cent. ovex [p-chlorophenyl p-chlorophenylsulphonate] or 3 per cent. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite] at 33–40 lb. per acre, but other materials gave inconsistent or inferior control. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate] in a dust and Holcomb compound 326 [O,O-diisopropyl N,N-diethylthiocarbamyl phosphorodithioate] and FW-152 [1,1-bis(p-chlorophenyl)-2,2-dichloroethanol] in sprays

were tested in 1954 and showed considerable promise. In a comparison of systemic insecticides in sprays applied at about 7, 13 and 20 U.S. gals. per acre on 2nd April and 6th July, there were no significant differences between demeton and methyl-demeton [dimethyl 2-(ethylthio)ethyl phosphorothioate] at about 1 lb. in 10 U.S. gals. and schradan at double the concentration; the high and medium rates of application did not differ significantly from one another but tended to be better than the low ones.

Daniels (N. E.). **Damage and Reproduction by the Flour Beetles,** *Tribolium confusum* **and** *T. castaneum*, **in Wheat at three Moisture Contents.**—*J. econ. Ent.* **49** no. 2 pp. 244–247, 2 figs., 7 refs. Menasha, Wis., 1956.

The following is based on the author's summary. As little is known of the behaviour of *Tribolium confusum* Duv. and *T. castaneum* (Hbst.) in whole wheat, the feeding and reproduction of these two species in whole-kernel wheat of 10·2, 12·2 and 14·2 per cent. moisture content at 80°F. was studied over a period of six months. Samples of 20 gm. wheat of each moisture content were infested with 50 adults, and the loss of weight and the numbers of progeny and of living and dead adults were determined after 60, 120 and 180 days. Most damage was caused and most young produced in the wheat with the highest moisture content. *T. confusum* caused more damage and reproduced more successfully than *T. castaneum*, causing 10·8 per cent. weight loss in 180 days and reaching a population equilibrium in 120 days in the wheat containing 14·2 per cent. moisture. Wheat kernels were first attacked by either species at the germ end. After the germ had been entirely consumed, the endosperm was eaten until, in some cases, it was completely consumed.

Kuitert (L. C.) & Guthrie (F. E.). **An unusual Method of passing the Summer by an Anthomyiid,** *Hylemya lupini* **(Coq.).**—*J. econ. Ent.* **49** no. 2 pp. 248–250, 2 figs., 6 refs. Menasha, Wis., 1956.

Most Anthomyiids are active during the summer, but as *Hylemyia lupini* (Coq.), an important pest of blue lupin in parts of Florida, appeared not to be [*cf. R.A.E.*, A **42** 386], investigations were made in 1953 and 1954.

In 1953, larvae collected on 11th May that were caged and allowed to pupate normally, pupae collected from the soil in a lupin field and buried in outdoor cages on 16th June, and pupae in the soil under heavily-infested plants that were caged in early May first gave rise to adults in November, when the flies were numerous in the field. Full-fed larvae collected in the field in another locality on 15th April and allowed to pupate in the laboratory gave rise to adults between early October and 20th November. In 1954, pupae collected on 5th May and kept in the laboratory with or without constant moisture, or without moisture and with four periods of refrigeration, for one week each month, or buried in the open, gave rise to adults between 25th October and 29th November, no treatment affecting the length of the pupal stage. The rate of emergence was low.

In two fields that had contained similarly infested crops, one of which was ploughed under in spring and followed by maize and the other left for seed, comparison of infestations in the following December, after both had been ploughed and sown with lupins in October–November, indicated that ploughing infested plants under may result in an effective reduction in infestation; subsequent frequent soil cultivation presumably contributes to it.

De (R. K.) & Konar (G.). **Effects of Schradan on Tetranychid Cotton Mites.**—*J. econ. Ent.* **49** no. 2 pp. 250–251, 9 refs. Menasha, Wis., 1956.

In a test against Tetranychid mites on cotton in India, infested plants in pots were sprayed with 0·3 or 0·5 per cent. commercial schradan in water, and the mites on leaves at the top, middle and bottom of the plants counted 24 hours before and 24 and 72 hours after treatment. Percentage reductions in population were calculated by Abbott's formula [*cf. R.A.E.*, A **13** 331]. For the lower concentration they were 90·5, 94·7 and 82·7 after 24 hours and 95·4, 94·6 and 77·5 after 72, and for the higher one they were 92·9, 95·6 and 96·2 after 24 hours and 98·8, 96·9 and 97·2 after 72, as compared with no treatment.

Shands (W. A.), Simpson (G. W.) & Wave (H. E.). **Some Effects of two Hurricanes upon Populations of Potato-infesting Aphids in northeastern Maine.**—*J. econ. Ent.* **49** no. 2 pp. 252–253, 2 refs. Menasha, Wis., 1956.

Two hurricanes passed over north-eastern Maine in the autumn of 1954, one on 31st August and 1st September and the other on 11th September, and observations were made of their effects on the potato-infesting Aphids, *Aphis abbreviata* Patch, *Myzus persicae* (Sulz.), *Macrosiphum solani* (Kalt.) and *M. solanifolii* (Ashm.). The first caused 52, 68, 1 and 32 per cent. decrease in populations of apterae of the four species on potato, and reduced feeding damage so much that there was no decrease in yield of tubers; as populations were already in their seasonal decline, the Aphids did not again reach injurious numbers. The second hurricane occurred when the autumn migration of *Macrosiphum solanifolii* and *Myzus persicae* to their primary food-plants was in progress. Counts on swamp rose (*Rosa palustris*) showed that the population increase of *Macrosiphum* was much decreased in comparison with the preceding year, and the normal autumn increase of *Myzus persicae* on Canada plum (*Prunus nigra*) was almost entirely prevented, so that few winter eggs were deposited and infestation was extremely low in the thickets in the following June and on potato in late July. *A. abbreviata* was much less affected; its primary food-plant, *Rhamnus alnifolia*, is low-growing and occurs in sheltered environments where wind speed is reduced, autumn populations on it were large, and the deposition of winter eggs had begun before 1st September.

Rabb (R. L.), Guthrie (F. E.), Splinter (W. E.) & Suggs (C. W.). **The Effect of Placement of Insecticidally treated Transplanting Water on the Control of Wireworms in Tobacco.**—*J. econ. Ent.* **49** no. 2 pp. 256–259, 3 figs., 3 refs. Menasha, Wis., 1956.

The standard method of protecting newly set tobacco from wireworms in the flue-cured tobacco belt of the United States is to add an insecticide to the water used at transplanting; this generally proves satisfactory when the water is applied from hand setters at rates of 200 U.S. gals. per acre or more, but has given poor protection when mechanical setters are used. Tests were carried out in three areas in eastern North Carolina in January–March 1955 in fields infested with wireworms of the genus *Conoderus*, the species being identified as *C. vespertinus* (F.) in two of the areas. About 4 oz. heptachlor (in 25 per cent. wettable powder or emulsion concentrate, the latter containing a mixture of ethyl acetate and isopropyl alcohol as the solvent) was applied in about 200 U.S. gals. water per acre with different

appliances at transplanting. The emulsion concentrate gave better results than the wettable powder, and the hand setter, which resulted in the wetting of all the soil round the plants and hence in excellent protection from attack, was superior to a mechanical setter, which did not wet the soil returned to the furrow after planting, or a modified mechanical setter designed to give the same water placement as a hand setter, which proved erratic in distribution. Doubling the amount of water applied by the mechanical setter did not improve protection.

Bray (D. F.). **Control of the Juniper Scale.**—*J. econ. Ent.* **49** no. 2 p. 260, 5 refs. Menasha, Wis., 1956.

Carulaspis visci (Schr.) (*Diaspis carueli* Targ.) has become an important pest of junipers (*Juniperus* spp.) in the north-eastern United States, and in preliminary tests at Stamford, Connecticut, the insecticide treatments usually recommended for its control proved ineffective. Observations in 1955 showed that the crawlers appeared between 3rd June and the beginning of July, and a heavily infested plantation was therefore sprayed thoroughly from the ground on 20th June (at the peak of crawler emergence), on 20th June and 5th July or on 10th, 20th and 28th June and 5th July with 4 lb. 25 per cent. wettable malathion per 100 U.S. gals., alone or with 1 lb. 25 per cent. wettable γ BHC as lindane. One and two applications of malathion alone reduced the scale population by 81 and 100 per cent., respectively, and control by a single application was not appreciably increased by the addition of γ BHC. Four applications caused some plant injury, which was greatest where γ BHC was added, but all plants were growing vigorously and showing natural colour by September.

Seal (W. L.) & Eden (W. G.). **Mites in Cricket Cultures and the Toxicities of several Acaricides and Insecticides to the House Cricket.**—*J. econ. Ent.* **49** no. 2 pp. 262–263, 2 refs. Menasha, Wis., 1956.

The following is based partly on the authors' summary. *Acheta domesticus* (L.) is reared in the south-east of the United States for fish bait, and the cultures at various localities have in recent years been infested by mites of several species, one of which was identified as *Tyrophagus breviceps* (Banks). Their relation to the cricket was not ascertained. As a preliminary to tests on their control, the effect of various toxicants on the cricket was investigated. Wettable-powder sprays of 0·075–1·5 lb. Aramite [2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite], 0·2–4 lb. DMC [1,1-bis(p-chlorophenyl)ethanol], 0·25–5 lb. Ovotran [p-chlorophenyl p-chlorophenylsulphonate (ovex)] or 0·125–2·5 lb. Karathane (dinitrocaprylphenylcrotonate) per 100 U.S. gals. water showed no toxicity when applied to the crickets until they were thoroughly wet, and the median lethal deposits of lindane [almost pure γ BHC], heptachlor, chlordane and endrin, applied in benzene solution to plywood, were 7·8, 12·9, 100·2 and 128 μg. per sq. cm., respectively, for exposures of one hour and an observation period of 24 hours. There were no significant differences in mortality between males and females.

Smith (R. H.). **A Technique for studying the Oviposition Habits of the Southern *Lyctus* Beetle and its Egg and early Larval Stages.**—*J. econ. Ent.* **49** no. 2 pp. 263–264, 3 figs. Menasha, Wis., 1956.

The following is based on the author's introduction and summary. *Lyctus planicollis* Lec. causes losses in the United States by damaging

seasoned wood products made from ring-porous hardwoods. As the female rests on the surface of the wood and inserts its ovipositor into a pore opening and down a vessel beneath the surface to lay an egg, oviposition is difficult to observe. A technique is described that enables observations to be made and photographs taken of the process and of the subsequent development of the first-instar larva. The springwood vessels along the tangential surface of a piece of hickory sapwood are exposed and then covered with a thin piece of glass to form tubular cells with pore openings to the surface; a female confined on this area oviposits in these visible vessels. Eggs were found to be laid 1–7 mm. down the vessels, and the time required for one to be deposited was about 45 seconds. The larva completes its development in the caudal portion of the egg in eight days, feeds on the yolk for 2–4 days and then leaves the egg-shell and enters the wood adjacent to the vessel.

Walter (E. V.) & Wene (G. P.). *Oligonychus pratensis*, **a new Mite on Corn.**—*J. econ. Ent.* **49** no. 2 pp. 265–266, 2 refs. Menasha, Wis., 1956.

Unthrifty dent maize examined at Weslaco, Texas, in May 1954 was found to be infested by *Oligonychus pratensis* (Banks) [*cf. R.A.E.*, A **43** 238]. Dusting with sulphur failed to control the mite, and complete loss of crop resulted. Infestation of sweet and field maize was observed in other fields in May and early June. In 1955, the mite appeared to be distributed throughout the Lower Rio Grande Valley, and several fields of dent maize were seriously injured. Most wild grasses and sedges and many weeds, including *Amarantus retroflexus*, were infested in such fields. *O. pratensis* appears to be generally distributed in the United States west and south of Kansas and is a threat to grain sorghums as well as to maize; early sweet maize is sometimes marketed before the mites become abundant enough to do much harm. *O. pratensis* has possibly been favoured by drought, but infestation on sweet maize at harvest was most severe in fields that had been dusted with 10 per cent. DDT against the earworm [*Heliothis zea* (Boddie)].

Srivastava (U. S.) & Srivastava (P. D.). **Soap as Spreader and Insecticide.**—*J. econ. Ent.* **49** no. 2 pp. 266–267, 5 refs. Menasha, Wis., 1956.

Experiments in India to determine the spreading properties of soap, in which the leaves of some 30 economic species of plants were dipped in soap solutions or sprayed with them, showed that the minimum concentration for complete wetting was 0·2–0·5 per cent., being slightly higher for sprays than for dips; this indicates that liquid insecticides with a surface tension of about 25·23 will spread successfully on most plants and that more than 0·5 per cent. soap in a spray is excessive if it is used only as a spreader.

Field tests of soap solutions for the control of *Rhopalosiphum pseudobrassicae* (Davis) (*Siphocoryne indobrassicae* Das) showed that they caused 29·5–78·1 per cent. mortality at concentrations of 2–3·5 per cent. and complete kill at 4 per cent.

Charpentier (L. J.). **1954 Studies of Parasites for Sugarcane Borer Control in Louisiana.**—*J. econ. Ent.* **49** no. 2 pp. 267–268, 1 ref. Menasha, Wis., 1956.

Of the introduced parasites liberated in Louisiana for the control of the larvae of *Diatraea saccharalis* (F.) on sugar-cane, only *Metagonistylum*

minense Tns. and *Lixophaga diatraeae* (Tns.) showed an ability to survive the winter there, though neither of them increased in numbers or persisted for more than a few years [*cf. R.A.E.*, A **31** 291]. Fresh releases in 1953 gave encouraging results, however, and in 1954, pupae received from Trinidad were allowed to transform in the laboratory and the adult Tachinids were fed for 4–5 days and then released near Houma. Between 19th April and 22nd July, 3,873 adults of *M. minense* and 6,741 of *L. diatraeae* were liberated in nine plantations, and surveys from 20th September to 21st October showed that both species had become established in all of them, giving averages of 16·2 and 12·6 per cent. parasitism, respectively. Early in the same season, 465 adults of *Paratheresia claripalpis* (Wulp) were released in another field, but no recoveries were made.

Collections made at intervals from January to October 1954 in a field in which *Lixophaga* appeared to have become established in 1953 showed up to 10·5 per cent. parasitism in January–June and 53·8–75 per cent. in September and October, when the parasite was also found 0·5–2 miles away. Other evidence confirmed that it had survived the winter, when the minimum temperature was 25°F. in this field, but it failed in three other plantations in which it had become established in 1953. *M. minense* was found 1–2 miles from the nearest release points in the autumn of 1954. The variety of cane on which the parasites appeared to be most effective was C.P.36/13. This variety is susceptible to *D. saccharalis*, so that larval populations are large and active, and abundant honeydew, on which the adult parasites presumably feed, is provided on it by *Dysmicoccus* (*Pseudococcus*) *boninsis* (Kuw.), *Carolinaia* (*Hysteroneura*) *setariae* (Thos.) and *Sipha flava* (Forbes). Laboratory tests of the effect on adults of *M. minense* and *L. diatraeae* of cryolite and ryania, which are commonly used for the control of *D. saccharalis*, gave erratic results, but both species survived commercial applications of ryania against the second-generation larvae.

Apanteles angaleti Mues., *Bracon brevicornis* Wesm., an undescribed species of *Chelonus* and *C. heliopae* Gupta, which parasitise various Lepidoptera in India, were also imported and released against *D. saccharalis* near Houma, but were not recovered from autumn or winter collections of larvae.

Chamberlain (W. F.). **Insecticide Tests against the Three-cornered Alfalfa Hopper.**—*J. econ. Ent.* **49** no. 2 pp. 268–269, 3 refs. Menasha, Wis., 1956.

Spissistilus festinus (Say) damages lucerne regularly, though less severely than some other insects, in the southern United States [*cf. R.A.E.*, A **3** 333]. In South Carolina, four generations of this Membracid per season are possible, but populations remain low until the appearance of the overwintering generation in autumn. The eggs of this generation are laid in July or early August, when few adults are present in the field, and the young nymphs feed at the base of the plants and are difficult to dislodge. In 1955, a lucerne field was cut on 6th July, 5th August and 8th September and treated with insecticides on 16th, 20th and 27th July and 13th, 19th and 24th August. Few insects could be swept from the plants at the beginning of the experiment, but an average of 23 per 20 sweeps was taken on untreated plots on 5th September, as compared with 0, 1 and 1·5 per 20 sweeps from plots receiving, per acre, 2 lb. DDT in an emulsion spray, 20 lb. 10 per cent. DDT dust or 0·5 lb. parathion in an emulsion spray. The field was not cut again until 16th November, and treatment was meanwhile continued with dusts of 10 per cent. DDT or methoxy-DDT (methoxychlor), 4 per cent. malathion, 20 per cent. toxaphene or 1 per cent. parathion, which

were applied on 20th and 27th September and 4th, 11th, 18th and 25th October. All these prevented the population from increasing above a low level throughout October and early November, though there was a slight rise in numbers by 15th November, whereas populations on untreated plots averaged 10–108 per 20 sweeps throughout this period.

Kerr jr. (T. W.) & McLean (D. L.). **Biology and Control of certain Lathridiidae.**—*J. econ. Ent.* **49** no. 2 pp. 269–270, 2 refs. Menasha, Wis., 1956.

The authors review records of Lathridiids in Rhode Island and give details of experiments in which four species were reared on various moulds in the laboratory. One of them was *Adistemia watsoni* (Woll.), and this species formed 95 per cent. of a collection of 1,124 larvae and adults from a warehouse in 1954. In preliminary tests on control, DDT, chlordane and dieldrin proved effective against adults of this species, and in more detailed ones, 50 per cent. wettable dieldrin powder diluted with water (1:90) and applied to wood gave complete kill of adults confined on the residue for an hour 101 days later, whereas an emulsion concentrate containing 1·5 lb. dieldrin per U.S. gal. diluted with water (1:32) lost some of its effectiveness 77–101 days after application. The warehouse was sprayed with 3 lb. 50 per cent. wettable dieldrin per 30 U.S. gals. water on 25th May 1955, and no living Lathridiids were found in it during the next four months.

Jenkins (L.) & Thomas (G. W.). **European Corn Borer attacking Cotton in Missouri.**—*J. econ. Ent.* **49** no. 2 pp. 270–271, 2 figs. Menasha, Wis., 1956.

Pyrausta nubilalis (Hb.) was observed infesting cotton in south-eastern Missouri and western Tennessee in the summer of 1955 and caused wilting above the point of entry, which was usually in the upper third of the stalk. Small numbers of infested plants were found throughout the cotton-growing areas of Missouri in late August, but the percentage infestation averaged less than 0·05 and did not exceed 1·2. A few young larvae were observed in bolls on 19th August, and additional boll damage was found in early September. Many second- and third-instar larvae fed on the surface between the bracts and bolls before boring into the latter, whereas other third-instar and larger larvae bored directly into them, causing injury similar to that by the cotton bollworm [*Heliothis zea* (Boddie)]; later, some infested bolls were found containing full-fed larvae. An egg-mass was observed on the upper surface of a cotton leaf in mid-August. Overwintering fifth-instar larvae were found in three of 12 cotton fields examined on 7th December; the percentage of damaged stalks containing overwintering larvae in these three fields was 1–2.

Beckel (W. E.). **Further Tests of Lindane in Floor Wax for the Control of Silverfish (Thysanura).**—*J. econ. Ent.* **49** no. 2 pp. 271–272, 1 ref. Menasha, Wis., 1956.

As the effectiveness of lindane [γ BHC] in floor wax against silverfish [*Lepisma saccharina* L.] exposed on surfaces treated with it in earlier tests in Canada [*cf. R.A.E.*, A **44** 129] may have been due partly to fumigant action, the insects being confined under bell-jars, further tests were made in which they were released on the treated areas in open glass cylinders. They were exposed for 0·5–24 minutes, or until they showed signs of poisoning, to 1 or 5 per cent. γ BHC in oil and wax or wettable powder and

wax, and all tests showed that exposure for over 24 minutes was necessary for 50 per cent. knockdown; in some cases, symptoms of poisoning did not appear until three days after exposure. Exposure for up to an hour to either concentration was required to poison all the insects when a fan was kept blowing over the open cylinder, and when the insects were confined on deposits seven days old, exposures of 20–24 hours were necessary for complete knockdown; no recovery of insects was noted in these tests. It is concluded that γ BHC in floor wax is less effective against *L. saccharina* than was previously indicated.

KALOOSTIAN (G. H.). **Overwintering Habits of the Geminate Leafhopper in Utah.**—*J. econ. Ent.* **49** no. 2 p. 272, 9 refs. Menasha, Wis., 1956.

In experiments on the overwintering habits of *Colladonus geminatus* (Van D.), begun in Utah in September 1953, the leafhoppers were confined on mazzard cherry trees and either subjected to a temperature of 34°F. or kept out of doors, caged out of doors on peach and lucerne or kept on celery and lucerne in the greenhouse. There was a noticeable reduction of numbers in October, and all insects were dead by December except in the greenhouse, where a few survived until early April. Eggs were laid in the leaves of the trees and the leaf and stalk tissues of lucerne and celery in October and November, and the eggs began to hatch in early April on outdoor plants, having survived temperatures as low as −10°F. Hatching began in November in the greenhouse (at 70–80°F.), and eggs that were transferred there after being exposed to 34° for 30–120 days began to hatch within seven days. Eggs and first-instar nymphs that were transferred from the open to the greenhouse in mid-April gave rise to adults on 20th May; adults were observed outdoors at about the same time. It is concluded that *C. geminatus* overwinters in the egg stage in Utah, that no definite period of dormancy is required for hatching, low temperatures merely delaying development, and that eggs survive on the fallen leaves of trees or in the stem tissues and retained leaves of lucerne.

WEIDHAAS jr. (J. A.) & SHAW (F. R.). **Control of the *Taxus* Mealybug with Notes on its Biology.**—*J. econ. Ent.* **49** no. 2 pp. 273–274, 6 refs. Menasha, Wis., 1956.

Dysmicoccus (*Pseudococcus*) *cuspidatae* (Rau) caused severe damage to yew (*Taxus cuspidata*) at Northampton, Massachusetts, in June 1955. Notes are given on the life-history of this mealybug, which apparently resembles that recorded in New Jersey [*cf. R.A.E.*, A **31** 7, etc.], together with the results of experiments on control. When applied at 12–15 U.S. gals. per tree, upwards and outwards from beneath the branches, sprays of 100 U.S. gals. water containing 1 or 2 U.S. pints 47 per cent. malathion emulsion concentrate, 2 lb. 25 per cent. wettable malathion with 4 lb. 50 per cent. wettable DDT, and this last with the addition of 2 oz. Triton X-100, reduced the numbers of mealybugs per three twigs from 272–450 before treatment to 0–8 after two days and to 0 after seven; similar sprays containing 2 lb. 25 per cent. wettable malathion, alone or with Triton X-100, caused considerable reductions, but did not eliminate all mealybugs in a week, and 1 U.S. pint 25 per cent. BHC emulsion concentrate and 1 lb. 25 per cent. wettable BHC (with or without Triton X-100) were ineffective. A week after treatment, all trees were sprayed with 1 U.S. quart 57 per cent. malathion emulsion concentrate or 3 lb. each of 25 per cent. wettable malathion and 50 per cent. wettable DDT per 100 U.S. gals., and no living mealybugs could be found during July or August.

Shaw (F. R.) & Weidhaas jr. (J.). **Distribution and Habits of the Giant Hornet in North America.**—*J. econ. Ent.* **49** no. 2 p. 275, 10 refs. Menasha, Wis., 1956.

Vespa crabro germana Christ is recorded injuring lilac and syringa at Williamansett, Massachusetts, where it has apparently been established since about 1952–53. Large branches gnawed by this hornet contained larvae of the lilac borer [*Podosesia syringae* (Harr.)], but it is not known whether there was any association between the two. The distribution of the hornet in the United States and Canada is reviewed.

Highland (H. A.). **The Biology of *Ferrisiana virgata*, a Pest of Azaleas.** —*J. econ. Ent.* **49** no. 2 pp. 276–277, 21 refs. Menasha, Wis., 1956.

Ferrisiana virgata (Ckll.), all stages of which are briefly described and which is widely distributed in tropical and subtropical regions, was found attacking azaleas in Maryland. In the greenhouse, at a maximum temperature of 95°F. and 65 per cent. relative humidity, the duration of the immature stages averaged 28·8 and 38 days, with three and four moults, respectively, for females and males, and the period from egg to oviposition was 42–56 days for ten females. Field observations over a period of 17 months from June 1954 showed that the nymphs left their overwintering sites in early April and fed at the axils of old and new leaves and at the bases of flower buds. Nymphs of the next generation appeared during the second week of June, and fed on all parts of the plants except the roots and main stem, and those of the overwintering generation appeared in early August. These ceased feeding when the weather got cooler and passed the winter in empty seed capsules of the previous year. No honeydew was produced. The overwintering nymphs were heavily parasitised by *Zarhopalus inquisitor* (How.) and *Pseudaphycus meritorius* Gah.; 1–2 adults of the former and ten of the latter were observed to emerge from single hosts. Other Encyrtid parasites recorded from *F. virgata* in the literature are listed. Spraying the plants to run-off with 1·5 quarts 57 per cent. emulsifiable malathion per 100 gals. in August 1954 appeared to give complete control on heavily infested plants.

Sweetman (H. L.). **Rearing successive Generations of the Carpet Beetle under controlled Conditions.**—*J. econ. Ent.* **49** no. 2 pp. 277–278, 15 refs. Menasha, Wis., 1956.

Anthrenus scrophulariae (L.), *A. verbasci* (L.), *A. flavipes* Lec. and *Attagenus megatoma* (F.) (*piceus* (Ol.)) are common and widely distributed pests of wool and other animal and plant products in the United States, but apparently only the last three can maintain themselves continuously on such material. Adults of all four visit flowers during spring and summer, and it is possible that some nutritive material from these is essential for reproduction by *Anthrenus scrophulariae*. Laboratory-reared adults of this species were therefore offered foods consisting of brewer's yeast, soy-bean flour, honey and pollen that had been collected and stored by bees, separately or together, and woollen fabric sprinkled with yeast was provided as an oviposition stimulus and larval food. Reproduction occurred in the culture given a mixture of all four foods, and a thriving colony developed in early spring and gave rise to adults, a few of which were still alive in September.

Eden (W. G.). **Influence of Nitrogen Fertilizer, Spacing, and Irrigation on Control of the Corn Earworm in Sweet Corn.**—*J. econ. Ent.* **49** no. 2 pp. 278–279, 2 refs. Menasha, Wis., 1956.

In the course of investigations in Alabama on factors that might affect *Heliothis zea* (Boddie) and its control on sweet maize, an experiment was carried out in 1955 in which plants set 8, 12 and 16 ins. apart and receiving 58, 88 or 118 lb. nitrogen fertiliser per acre were either irrigated with 1·5 in. water on 6th June or not irrigated. All plots were sprayed seven times at three-day intervals from 23rd May, when about 25 per cent. of the stalks were in silk, with 2 lb. DDT in 15 U.S. gals. emulsion spray per acre, and examination of ears on 14th June showed no significant differences in the mean percentage of uninfested ears due to irrigation, rate of application of nitrogen or spacing.

Polivka (J. B.). **A Caddy-cart Type of Table for Grub Survey.**—*J. econ. Ent.* **49** no. 2 pp. 279–280, 4 figs. Menasha, Wis., 1956.

The author describes a portable apparatus for sampling Lamellicorn larvae in turf, made by replacing the golf-bag attachments of a caddy cart with a detachable table top and other equipment, and the method of using it.

Watters (F. L.) & Sellen (R. A.). **Further Tests with DDT and Pyrethrins-Piperonyl Butoxide against the Hairy Spider Beetle.**—*J. econ. Ent.* **49** no. 2 pp. 280–281, 2 refs. Menasha, Wis., 1956.

DDT and mixtures of pyrethrins and piperonyl butoxide have been shown to be effective against *Ptinus villiger* Rttr. [*cf. R.A.E.*, A **42** 20] and are widely used for its control in cereal warehouses in western Canada. In view of a report that DDT had proved inadequate in 1953, experiments were carried out to determine whether this was due to misapplication. An emulsified solution of 5 per cent. DDT (w/v) was applied as a coarse wetting spray at 1 gal. per 1,000 sq. ft. to the floors and lower 5 ft. of the walls of infested rural warehouses in April and again in June, and counts during September of immature stages of *P. villiger* in small bags of flour exposed on the floor after the April treatment showed the presence of very small numbers in nine warehouses treated by a laboratory officer and in six treated by warehousemen, but significantly higher numbers in four others treated by warehousemen, resulting in means of 2·8 and 52 per three bags for warehouses treated by the laboratory officer and warehousemen, respectively.

In similar tests with mixtures of 0·1 per cent. pyrethrins and 0·8 per cent. piperonyl butoxide in base oil, applied at 1 gal. per 1,000 sq. ft., poor results were obtained in all warehouses, with no significant differences between treatments by the laboratory officer and warehousemen, presumably because the deposits, which averaged 4·5 mg. pyrethrins and 36 mg. piperonyl butoxide per sq. ft. were too low [*cf. loc. cit.*].

Wallace (L. E.). **Control of the Raspberry Root Borer.**—*J. econ. Ent.* **49** no. 2 p. 287. Menasha, Wis., 1956.

Pennisetia (*Bembecia*) *marginata* (Harr.) is an important pest of cultivated raspberry in Oregon. The larvae weaken the plants by feeding in the roots and crowns, and development lasts two years. Before pupating, they tunnel in the base of the canes and so kill them. In control experiments, sprays were applied to the bases of the canes at rates of 1,512 and 756 U.S. gals.

per acre, respectively, on 6th September 1952 and 11th September 1953, 18 and 21 days after adult emergence had begun, and plants were dug two years later, on 5th–11th August 1954 and 22nd–29th August 1955, and examined for larvae and pupae. The insecticides were used at 4 and 8 lb. wettable powder per 100 U.S. gals., and the two concentrations of 50 per cent. DDT gave 100 and 82 per cent. reduction of population, respectively, in 1954 and 86 per cent. in 1955, 25 per cent. parathion powder gave complete control in both years and 40 per cent. chlordane powder was ineffective.

Davis (E. G.). **Status of the Wheat Stem Sawfly in the United States in 1954.**—*Bi-m. Bull. N. Dak. agric. Exp. Sta.* **17** no. 5 pp. 171–175, 1 map, 3 refs. Fargo, N. Dak., 1955.

Davis (E. G.), Benton (C.) & Somsen (H. W.). **Natural Enemies of the Wheat Stem Sawfly in North Dakota and Montana.**—*Op. cit.* **18** no. 2 pp. 63–65.

In the first paper, the bionomics of *Cephus cinctus* Nort. and the history of its spread from wild grasses to wheat in parts of the United States and Canada are reviewed, and it is shown that the sawfly is now an important pest of spring wheat in North Dakota and Montana where it caused losses amounting to 17 million dollars in 1952. It is less important in the winter-wheat belt, to the south of the spring-wheat area, as the crop matures and dries up before the larvae are able to complete their feeding. Surveys of its distribution in the United States have been made since 1947, and a map is given showing the areas in which the sawfly attacks both native grasses and wheat and those in which it attacks native grasses only. County records where the food-plant is not known are also indicated. By 1954, the sawfly had been recorded in Montana east of the Rockies, North and South Dakota, Nebraska. Wyoming, Utah, Colorado, western Kansas, western Minnesota and north-western Iowa, and its areas of maximum abundance coincided closely with the distribution of its preferred food-plant, *Agropyrum smithii*.

It is stated in the second paper that larvae of *C. cinctus* are parasitised in the United States by seven indigenous Hymenoptera, *Bracon cephi* (Gah.), *B. lissogaster* Mues., *Eupelmella vesicularis* (Retz.), *Eupelmus allynii* (French), *Eurytoma atripes* Gah., *Pleurotropis utahensis* Crwf. and *Ephialtes* (*Scambus*) *detritus* (Hlmgr.). Up to almost 100 per cent. of the larvae, and commonly 25–30 per cent. of them, are parasitised in native grasses, but rarely more than 2 per cent. in wheat. *Collyria calcitrator* (Grav.) and *Bracon terebella* Wesm., which parasitise the eggs and larvae and the larvae, respectively, of *Cephus pygmaeus* (L.) on wheat in Europe, were obtained from France and released in 1952–54 in two areas in North Dakota and one in Montana. Small numbers of *Collyria* were recovered from larvae of *Cephus cinctus* in wheat stubs in the autumn of 1953 and from larvae collected in May 1954 at one of the release points in North Dakota, and the parasite had thus succeeded in overwintering. It is not yet known whether it will become permanently established. *B. terebella* has not so far been recovered.

Maramorosch (K.). **Mechanical Transmission of Curly Top Virus to its Insect Vector by Needle Inoculation.**—*Virology* **1** no. 3 pp. 286–300, 1 fig., 39 refs. New York, N.Y., 1955.

The following is virtually the author's summary. Curly top virus was transmitted mechanically to *Circulifer tenellus* (Baker), its insect vector, by

needle inoculation, by means of an improved microinjector. No transmission by the anal route was obtained. Mechanically inoculated insects could transmit curly top virus only after an incubation period, which varied with the dose of inoculum. The introduction of virus-containing juices at a 1:30 dilution resulted in incubation periods of 1 to 9 days; a 1:300 dilution was followed by incubation periods of 5 to 20 days.

Maramorosch (K.). **Mechanical Transmission of Clover Club-leaf Virus to its Insect Vector.**—*Bull. Torrey bot. Cl.* **82** no. 5 pp. 339–342, 16 refs. New York, N.Y., 1955.

The following is virtually the author's summary. Clover club-leaf virus from viruliferous *Agalliopsis novella* (Say) and from diseased *Trifolium incarnatum* plants was injected, after dilution, into 100 virus-free insects of the vector species. Mechanical transmission from insect to insect and from plant to insect was successful. After an incubation period of more than 4 weeks, 6 of 22 insects inoculated with virus from insects and 3 of 17 inoculated with virus from plants became infective. One hundred untreated insects of the vector species, tested as controls, proved virus-free. The mechanical transmission of club-leaf virus provides a technique for the detection and study of this virus *in vitro*.

Littau (V. C.) & Maramorosch (K.). **Cytological Effects of Aster-yellows Virus on its Insect Vector.**—*Virology* **2** no. 1 pp. 128–130, 1 fig., 8 refs. New York, N.Y., 1956.

Although the virus of aster yellows is known to multiply in its insect vector, *Macrosteles fascifrons* (Stål) [*cf. R.A.E.*, A **44** 412, etc.], no symptoms of disease have so far been detected in the latter. When infected and uninfected examples were fixed and stained, differences were found in the appearance of cells of the fat-body. In infected insects, many of these cells appeared abnormal or broken in the sections, and the nuclei tended to be stellate, instead of round or smoothly contoured, and the cytoplasm reticulate.

Jensen (D. D.). **Insect Transmission of Virus between Tree and Herbaceous Plants.**—*Virology* **2** no. 2 pp. 249–260, 2 figs., 18 refs. New York, N.Y., 1956.

Progress in studies of the host-plant range of fruit-tree viruses has been slow because mechanical transmission of such viruses to herbaceous plants is not easy, the symptoms are slow in developing, and little was known until recently of their insect vectors. In experiments carried out in 1954–55 in California and described in this paper, *Colladonus geminatus* (Van D.) transmitted the virus of yellow leaf-roll of peach [*cf. R.A.E.*, A **40** 243] from peach to celery and three strains of Western X-disease from cherry (in which it is also known as cherry buckskin) to celery. The symptoms caused by the viruses in celery, which are described, appeared in 4–6 weeks. Yellow leaf-roll was also transmitted by *C. geminatus* from celery to celery and back to peach. Neither *C. geminatus* from infected celery nor *Macrosteles fascifrons* (Stål) from infected *Plantago* transmitted the western aster-yellows virus to peach.

MARAMOROSCH (K.). **Multiplication of Aster Yellows Virus in *in vitro* Preparations of Insect Tissues.**—*Virology* **2** no. 3 pp. 369–376, 17 refs. New York, N.Y., 1956.

The following is virtually the author's summary. Nymphs of *Macrosteles fascifrons* (Stål) were allowed to feed for two days on diseased plants of China aster (*Callistephus chinensis*) to acquire aster-yellows virus. No virus was recovered when juices of these leafhoppers were injected into virus-free leafhoppers on the following day. However, virus was recovered by the same injection method after the nymphs had been cut into pieces and their living tissues incubated for 10 days in a suitable medium in hanging drops. This experiment demonstrated that aster-yellows virus could complete its incubation not only in vectors feeding on a constant supply of fresh plant food, but also in insect tissues *in vitro*. The experiment provided additional evidence for multiplication of this plant virus in the tissues of its insect vector [*cf. R.A.E.*, A **44** 412, etc.].

VAN SOEST (W.) & DE MEESTER-MANGER CATS (V.). **Does the Aphid *Myzus persicae* (Sulz.) imbibe Tobacco Mosaic Virus?**—*Virology* **2** no. 3 pp. 411–414, 2 figs., 3 refs. New York, N.Y., 1956.

The following is virtually the authors' summary. In order to investigate whether *Myzus persicae* (Sulz.) takes up tobacco mosaic virus, droplets emerging from stylets cut while Aphids were feeding were tested for the virus by inoculation of *Nicotiana rustica* and tobacco (*N. tabacum* var. White Burley), examination under the electron microscope, and a micro-serological method. All gave negative results. Consequently the authors are of opinion that *M. persicae* does not imbibe tobacco mosaic virus from tobacco.

RUSSO (G.). **Riassunto circa i reperti bio-ecologici sul *Dacus oleae* e risultati della sperimentazione antidacica nella zona di Ascea (Salerno) nel 1954.** [Summary of Studies on the Bionomics of *D. oleae* and the Results of Control Experiments near Ascea (Salerno) in 1954.]—*Notiz. Mal. Piante* no. 34 (N.S. no. 13) pp. 35–39. Pavia, 1956.

This is a reprint of the summary of an account already noticed [*R.A.E.*, A **45** 131] of experiments on the control of *Dacus oleae* (Gmel.) on olive near Salerno in 1954.

VENEZIA (M.) & PAPADANTONAKIS (S.). **Contributo alla ricerca sulla tossicità del parathion nell'olio di olive.** [A Contribution to Research on the Toxicity of Parathion in Olive Oil.]—*Notiz. Mal. Piante* no. 34 (N.S. no. 13) pp. 43–49, 7 refs. Pavia, 1956.

The authors review the advantages of the use of parathion for the control of *Dacus oleae* (Gmel.) on olive in Italy, refer to Aiazzi-Mancini's conclusion that residues of up to 25 parts parathion per million in olive oil do not constitute a danger to consumers [*R.A.E.*, A **44** 138] and give an account of experiments on the toxicity of parathion in olive oil to guineapigs and rabbits. Olive oil to which parathion had been added was administered daily to groups of six animals, either in the normal food or directly through the mouth, at the rate of 0·5 gm. per guineapig and 1·75 gm. per rabbit. No symptoms of poisoning were observed in any of the animals after oil containing 10 p.p.m. parathion had been administered for one month, and

the parathion content was increased during the next two months to 20 p.p.m. At the end of this period, all the animals receiving the oil in their food were normal, but the fur of some of those receiving it directly was in poor condition and no weight increase was shown. The parathion content of the oil was then increased to 25 p.p.m. There were again no ill-effects among animals receiving the oil in their food, but there were obvious symptoms of poisoning after 25 days among those receiving it directly in the mouth and one guineapig in this group died on the 25th day. When the administration of oil was suspended for three days, the surviving animals completely recovered, and they remained healthy throughout the following three months when oil containing 23 p.p.m. parathion was administered daily directly through the mouth. Those receiving the oil with their food showed no symptoms when oil containing 30 p.p.m. was administered daily for eight months, after which time the experiment was terminated.

Bognár (S.). **A "drótféreg" kérdés és az újabb védekezési kísérletek eredményei.** [The Wireworm Problem and the Results of latest Experiments for their Control.]—*Növénytermelés* **3** no. 1–2 pp. 143–158, 6 figs., 24 refs. Budapest, 1954. (With Summaries in Russian and English.)

An account is given of experiments on the control of wireworms carried out in 1952–53 on heavy soil in a district in western Hungary in which *Agriotes obscurus* (L.) and *A. lineatus* (L.) constituted 70 per cent. of the population and *A. sputator* (L.) 27 per cent. In the first, several soil treatments were applied at the end of April and the beginning of May to plots in which the wireworm population averaged about 30 per sq. yard. Potatoes were then planted. A dust containing 9·1 per cent. chlordane (Octaterr), a bait consisting of a 1:10 mixture of this and ground wheat, and a dust containing 0·8 per cent. γ BHC (Agritox) were broadcast at rates of 0·3, 1·65 and 0·9 oz. per sq. yard, respectively, and incorporated into the soil to a depth of 6–8 ins., and all these reduced injury to an economically insignificant level. Other materials, including a dust containing 3·5 per cent. p,p′DDT (Hungaria Matador), proved ineffective.

In a further test, at the beginning of May, the DDT dust and a dust containing 8 per cent. α BHC, which was thought to have repellent properties, were applied to the seed tubers at 0·17 and 0·24 per cent. by weight before planting in untreated soil. Some protection was afforded to the planted tubers, but none to the shoots or new tubers. Treatment of wheat and maize seeds with the γ BHC dust at 1 per cent. by weight gave good protection, the loss of plants being only 23 and 26 per cent. after 5 and 15 weeks, respectively, for wheat, as compared with 64 and 70 per cent. for no treatment, and 0 and 4 per cent. for maize, as compared with 29 and 38 per cent. for no treatment. When wheat that had been treated against the granary weevil [*Calandra granaria* (L.)] with 0·2 per cent. of its weight of the γ BHC dust or one containing 5 per cent. DDT and 1 per cent. γ BHC was sown about six months after treatment, the losses of plants, as compared with the numbers of seeds sown, were 10 and 13 per cent. after 5 weeks and 17 and 18 per cent. after 15 weeks, respectively, and when maize seed was treated with the dust containing α BHC at the rate of 1 per cent., the losses were 14 and 18 per cent. To investigate the effect of seed treatment on injury by wireworms in autumn and spring to winter wheat, a test was carried out in October in which the dust containing 0·8 per cent. γ BHC was applied to the seed at 1 per cent. by weight. As compared with no treatment, the yield was increased by 120–150 per cent. and the wireworm population decreased to one-third of its original density.

From tests of the flavour and odour of potatoes from the various plots, it is concluded that because of their tainting effect BHC and chlordane should not be applied to this crop. It is further concluded that the most economic treatment for wheat and maize is seed treatment with Agritox at 1 per cent. by weight, while especially valuable plants may justify soil treatment with Octaterr or Agritox at about 35 or 110 lb. per acre, respectively.

Bognár (S.). **A kis drótféreg** (*Agriotes obscurus* **L.**) **bénító és pusztító parazitája a** *Pristocera depressa* **Fabr.** [*P. depressa*, a paralysing and destructive Parasite of the Wireworm, *A. obscurus*.]—*Növénytermelés* **4** no. 3 pp. 241–252, 10 figs., 9 refs. Budapest, 1955. (With Summaries in Russian and English.)

During investigations in 1952–54 on the control of wireworms in western Hungary [*cf.* preceding abstract], *Pristocera depressa* (F.) was observed for the first time parasitising larvae of *Agriotes obscurus* (L.). The distribution of this Bethylid is reviewed, and all stages except the egg are briefly described. In the laboratory, adults of both sexes attacked and mutilated wireworms placed close to them, and fed on their body fluids, and the females paralysed others, but oviposition did not occur. Mutilated wireworms died in 1–2 days, whereas those paralysed by the females remained alive for 14–19 days. At 20–24°C. [68–75·2°F.] and 70 per cent. relative humidity, males and females collected in the field or reared in the laboratory lived for 7–65 and 6–56 days, respectively, and destroyed an average of 2–3 wireworms per day. The larvae of the parasite fed externally and were incapable of locomotion, except just before pupation, and not more than one was found per host. When young larvae were transferred from one host to another, they died. The pupal stage lasted 10–12 days, but some of the newly emerged adults hibernated in the cocoons. The percentage parasitism was only 4·4–12·5, but the adult feeding habits render the parasite of greater importance than is indicated by these figures.

Terényi (S.) & Bognár (S.). **A répaaknázómoly és az 1950–1953 évi védekezési kísérletek eredményei.** [*Gnorimoschema ocellatella* and the Results of Experiments carried out in 1950–53 for its Control.]—*Növénytermelés* **4** no. 1 pp. 67–88, 10 figs., 33 refs. Budapest, 1955. (With Summaries in Russian and English.)

Gnorimoschema ocellatella (Boyd), the distribution of which is reviewed, was observed attacking beet for the first time in Hungary in 1950. It spread northwards and had reached Czechoslovakia by August 1952. Investigations in 1950–53 showed that beet was its only food-plant, and seed crops, root crops and stecklings were all attacked. The egg, larval and pupal stages lasted 7, 30–44 and 11–67 days, respectively, and winter was passed by the larvae in all instars and by the pupae. Adults of the overwintering generation emerged at the end of March, when the seed crop began to shoot, and the females laid 5–41 eggs each, with an average of 23; 80 per cent. of them were laid on the leaves and the rest on the petioles. The larvae first fed on the leaves and later burrowed in the petioles and the upper parts of the roots. There were several overlapping generations a year, all stages being present together.

Infestation was most severe in the dry southern regions, and irrigation was found to be an important means of control [*cf. R.A.E.*, A **33** 120]. On one farm in 1950, the percentages of plants infested were 40–50 where irrigation was applied fortnightly, 1–2 where it was applied weekly, and 100

where no irrigation was practised. Numerous insecticides were tested for control in the four years, and the results, which are given in detail in tables, showed that BHC and DDT applied in dusts and sprays did not effectively control the larvae in mature beet even at high rates of application, whereas sprays of 0·04–0·05 per cent. parathion at normal rates varying with the growth of the plants gave over 90 per cent. control, as calculated by Abbott's formula [*cf.* **13** 331]. The larvae were attacked by various natural enemies, including a predacious Syrphid and the Braconids, *Chelonus* (*Chelonella*) *contractus* (Nees), *Bracon* sp. and *Orgilus* sp., which afforded 4–17 per cent. parasitism in 1952, and the Ichneumonid, *Cremastus ornatus* Szépl., which afforded 1·54 per cent.

Stevenson (J. H.). **Onderzoek naar de wijze, waarop de koolzaadgalmug** (*Dasyneura brassicae* **Winn.) haar eieren legt op koolzaad** (*Brassica napus* **L.).** [Observations on the Oviposition of *D. brassicae* on Rape.] —*Tijdschr. PlZiekt.* **61** pt. 3 pp. 81–87, 2 pls., 4 refs. Wageningen, 1955. (With a Summary in English.)

Among the insects that attack rape in Holland are *Ceutorhynchus assimilis* (Payk.) and *Dasyneura brassicae* (Winn.). The author reviews their bionomics and describes observations carried out to determine whether the Cecidomyiid oviposits through holes made by the weevil, as has been claimed by Sylvin [*R.A.E.*, A **40** 54] and earlier workers. Adults of *C. assimilis* were observed to bore in individual pods for 5–10 minutes at a time, whereas those of *D. brassicae* remained on them for only short periods, during which it is unlikely that they had time to pierce the pods. Furthermore, the ovipositor of *Dasyneura* was found to be telescopic and not adapted for piercing. Holes in pods containing larvae of *Dasyneura* proved to be of two sizes, but all were too large to have been produced by the ovipositor of *Dasyneura*, though they could have been produced by *Ceutorhynchus*. It is concluded that Sylvin's view is correct [*cf.* also next abstract], and that control of *Ceutorhynchus* will reduce the number of holes available for oviposition by *Dasyneura*, though direct measures will probably be necessary as well.

Ankersmit (G. W.). **Over het verband tussen de aantasting door de koolzaadgalmug,** *Dasyneura brassicae* **Winn. (Diptera, Itonididae) en de koolzaadsnuitkever,** *Ceuthorrhynchus assimilis* **Payk. (Coleoptera, Curculionidae).** [On the Relation between Infestation on Rape by *D. brassicae* and *C. assimilis*.]—*Tijdschr. PlZiekt.* **61** pt. 3 pp. 93–97, 5 refs. Wageningen, 1955. (With a Summary in English.)

Since it has been diversely claimed that females of *Dasyneura brassicae* (Winn.) are able to oviposit in the pods of rape only when these have already been damaged, notably by *Ceutorhynchus assimilis* (Payk.) [*cf.* preceding abstract], and that females have been observed ovipositing in young, uninjured rape pods, investigations were carried out in Holland in 1952–54. When adults of *Dasyneura* were caged with uninfested plants on which some of the pods had been damaged by pricking with a needle, eggs were laid only on the latter, and no eggs were laid when only undamaged pods were provided. The results were the same in tests with pods in all stages of development.

In the field, females were observed moving over the pods in search of holes in which to oviposit. On occasion, two or more were observed ovipositing in the same holes, indicating that these were scarce. They were unable to pierce the inner wall of a pod, even though the outer wall had

been damaged. It is concluded that eggs are laid only in pods that have already been damaged. As *C. assimilis* is largely responsible for damaging pods in the field, control measures against the weevil should also give some control of *Dasyneura* by reducing the numbers of holes available. Though the effect on the first generation of the Cecidomyiid will be limited, a reduction in the numbers of *Ceutorhynchus* will reduce infestation by the second generation, as the females oviposit in the larval exit holes. During a test in 1953, the percentages of pods infested by larvae of *Ceutorhynchus* and (in brackets) of *Dasyneura* were 27 (13) for no treatment and 11 (6), 10 (7), 3 (3) and 2 (3) for sprays of chlordane, BHC, a mixture of BHC and dieldrin, and dieldrin alone, respectively, indicating that infestation by *Dasyneura* varies with that by *Ceutorhynchus*.

Franssen (C. J. H.). **De levenswijze en de bestrijding van de vroege akkerthrips (*Thrips angusticeps* Uzel.).** [The Bionomics and Control of *T. angusticeps*.]—*Tijdschr. PlZiekt.* **61** pt. 3 pp. 97–102, 1 ref. Wageningen, 1955. (With a Summary in English.)

In view of an increase in damage to field crops by *Thrips angusticeps* Uzel in Holland in recent years, investigations were begun on its bionomics and control. The thrips was found to have two generations a year, a short-winged overwintering generation and a long-winged summer one. The first was the more injurious, since the adults, which remained in the soil over one or two winters, appeared in the fields in early spring and caused much damage to young seedlings, sometimes killing them. Both were polyphagous, but the long-winged generation showed a preference for flax and to a less extent for barley and wheat. The eggs were laid on the plants, and the nymphs fed on the growing points and pupated in the soil. The symptoms of attack are described. On flax, *T. angusticeps* caused the injury known as bad heads, which had previously been attributed exclusively to *T. lini* Lad. [*cf. R.A.E.*, A **27** 233]. Beet, flax, onions, spinach, radish and rye-grass [*Lolium*] were very susceptible to attack, peas, broad beans (*Vicia*) and summer grains susceptible, and winter grains, lucerne and clover little damaged.

In control experiments in 1954, sprays of DDT, dieldrin and parathion were tested in several localities against both *T. angusticeps* and *Sitona lineatus* (L.) on young peas, treatments being applied when infestation by either was first observed and again ten days later. Parathion proved very effective against both pests at 0·36 lb. per acre and more so against the thrips than dieldrin at 0·1368 lb.; DDT at 0·72 lb. per acre was ineffective against *T. angusticeps*.

Lagaude (V.). **Observations concernant la mouche de la cerise et les moyens de la combattre.**—*C.R. Acad. Agric. Fr.* **40** no. 18 pp. 683–689, 2 graphs. Paris, 1954.

Experiments on the control of the ovipositing females of *Rhagoletis cerasi* (L.) on cherry, similar to those carried out in Vaucluse in 1953 [*cf. R.A.E.*, A **43** 28], were made in several communes in the Department of Gard in 1954. Observations on adult emergence and flight were made by caging overwintering pupae outdoors, and exposing bait-traps containing 3 per cent. ammonium stearate among the trees when examination of the pupae showed emergence to be imminent. The first adults were taken on 7th May and peak numbers were observed on 14th and 30th May, but there were some local differences. Sprays were applied on 20th–22nd May and 1st–2nd June. In one section, an emulsified solution of 0·1 per cent. DDT was used, and

in another, 0·2 per cent. of an emulsion concentrate containing 20 per cent. DDT and 3·5 per cent. lindane [almost pure γ BHC] was applied. Both kept the fruits virtually free from attack until all varieties, including the latest, had been picked, and no tainting of the cherries occurred. The difficulties of timing the sprays in orchards of mixed varieties, in view of the restrictions governing the interval between the last treatment and picking, are briefly discussed. In some of the orchards treated with DDT alone, a considerable increase in *Tetranychus* (*Amphitetranychus*) *viennensis* Zacher occurred in late July and early August, the attack being more severe in sandy, dusty soil than on clay soil. The mite was not observed in the area treated with the mixed spray.

Koizumi (K.). **Effect of constant Temperature upon the Development of the Potato Tuber Moth,** *Gnorimoschema operculella* **(Zeller).** [*In Japanese.*]—*Sci. Rep. Fac. Agric. Okayama Univ.* no. 7 pp. 36–45, 5 graphs, 6 refs. Okayama, 1955. (With a Summary in English.)

Gnorimoschema operculella (Zell.) which had not previously been found in Japan, was observed in May 1954 in a tobacco field in Hiroshima Prefecture and subsequently in Kyushu. It had presumably been introduced from Australia by troops of occupation. An account is given of laboratory studies on the development of the moth at constant temperatures of 10–15°C. [50–59°F.] and 80–90 per cent. relative humidity and 18–40°C. [64·4–104°F.] and 50–70 per cent. relative humidity. The material used in each test was reared at 27°C. [80·6°F.] and transferred to the experimental temperature, and potato tubers of medium size were used for rearing the larvae. The duration of the egg stage ranged from 40–52 days at 10°C. to 3·9 at 40°C., that of the larval stage from 64–111 days at 10°C. to 5–9 at 35°C. [95°F.], and that of the prepupal and pupal stages from 9–40 and 47–77 days at 10°C. to 1–3 and 5–7 days at 40°C. Hardly any of the eggs hatched at 40°C., whereas over 96 per cent. did so at 38°C. [100·4°F.] and over 46 per cent. at 10°C. The mean duration of total development decreased from 208·35 days at 10°C. to 16·77 days at 35°C. Males reared at 35–38°C. were sterile, but the females were not. When adults were reared at 27°C. and transferred to the experimental conditions, the percentage that paired and (in brackets) the average number of eggs deposited per female were 30·7 (54) at 10°C., 100 (84) at 27°C. and 33·3 (17) at 35°C.

Papers noticed by Title only.

Thomas (W. D. E.). **The Behaviour of systemic Insecticides in Plants: a Survey of Results obtained with ^{32}P-labelled Schradan and Demeton-S** [O,O-diethyl S-2-(ethylthio)ethyl phosphorothioate].—*J. Sci. Fd Agric.* **7** no. 9 pp. 565–573, 1 graph, 33 refs. London, 1956. [A review of the literature: *R.A.E.*, A **42** 320; **43** 131, 405; **44** 147.]

Telenga (N. A.). **Hymenoptera. Vol. V, pt. 4. Fam. Braconidae: Subfam. Microgasterinae, Subfam. Agathinae** [in U.S.S.R.]. [*In Russian.*]—*Fauna SSSR* N.S. no. 61, 10 × 6½ ins., 312 pp., 120 figs., refs. Moscow, Zool. Inst. Akad. Nauk SSSR, 1955. Price 19 *rub.* 45 *kop.* [*Cf. R.A.E.*, A **29** 480.]

Ross (H. H.). **A Textbook of Entomology.**—2nd edn., 9¼ × 6 ins., xi + 519 pp., 402 figs., many refs. New York, J. Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1956. Price £3 2*s*. [*Cf. R.A.E.*, A **37** 261.]

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INDEX OF AUTHORS

Ankersmit, G. W., 206.
App, B. A., 183.
Attiah, H. H., 167.

Badawy, A., 165, 166.
Ball, H. J., 190.
Barat, H., 172.
Beckel, W. E., 197.
Benton, C., 201.
Bishopp, F. C., 184.
Bognár, S., 204, 205.
Boyce, H. R., 175.
Bray, D. F., 194.
Brown, W. B., 163.
Burrage, R. H., 185.
Butler, L. I., 184.

Chamberlain, W. F., 196.
Charpentier, L. J., 195.
Chisholm, D., 180.
Church, N. S., 179.
Clancy, D. W., 186.
Clausen, C. P., 185.
Cleland, J. W., 174.
Cochran, J. H., 191.

Daniels, N. E., 192.
Davis, E. G., 201.
Davis, J. M., 187.
De, R. K., 193.
de Meester-Manger Cats, V., 203.
Dorsey, C. K., 189.

Early, J. D., 191.
Eden, W. G., 194, 200.
Eitel, W. J., 183.
Ely, R. E., 162.
Enoch, 172.

Franssen, C. J. H., 207.
Frappa, C., 171.
Fukuto, T. R., 181, 186.

Ghent, A. W., 174.
Glick, P. A., 183.
Goormans, C., 169.
Gurr, L., 174.
Guthrie, F. E., 192, 193.
Gyrisco, G. G., 185.

Habib, A., 164.
Hammad, S. M., 167.
Heimpel, A. M., 178.
Heuser, S. G., 163.
Highland, H. A., 199.
Hill, C. H., 188.
Hobbs, G. A., 180.
Hollingsworth, J. P., 183.
Hough, W. S., 188.
Howland, A. F., 191.
Hurst, F., 173.

Ibrahim, M. M., 167.
Ives, W. G. H., 176, 179.

Janvier, H., 187.
Jefferson, R. N., 181.
Jenkins, L., 197.
Jensen, D. D., 202.
Jones, E. T., 185.

Kaloostian, G. H., 198.
Kelsey, J. M., 172, 173.
Kerr, jr., T. W., 197.
Khalifa, A., 165, 166.
Kirk, V. M., 190.
Klostermeyer, E. C., 184.
Koizumi, K., 208.
Konar, G., 193.
Kuitert, L. C., 192.

Lagaude, V., 207.
Landis, B. J., 184.
Leach, J. G., 189.
Lilly, C. E., 180.
Littau, V. C., 202.
Loschiavo, S. R., 175.

McAlister, H. J., 186.
McDowall, F. H., 173.
MacEachern, C. R., 180.
McKinley, K. S., 168.
McLean, D. L., 197.
MacPhee, A. W., 180.
Maramorosch, K., 201, 202, 203.
March, R. B., 181, 186.
Maxon, M. G., 186.
Metcalf, R. L., 181, 186.
Miller, B. S., 185.
Morishita, F. S., 181.
Morris, R. F., 177.

Nagel, R. H., 187.

Orian, G., 172.

Papadantonakis, S., 203.
Patchell, M. R., 173.
Pfadt, R. E., 181.
Phillips, G. L., 161.
Phillips, J. H. H., 175.
Polivka, J. B., 200.
Pujol, R., 169.

Rabb, R. L., 193.
Refai, F. Y., 185.
Reid, R. W., 177.
Rilett, R. O., 182.
Ross, H. H., 208.
Russo, G., 203.

Schoop, R., 184.
Seal, W. L., 194.
Sellen, R. A., 200.
Shands, W. A., 193.
Shaw, F. R., 198, 199.
Siakotos, A. N., 188.
Simpson, G. W., 193.
Smith, R. H., 194.
Somsen, H. W., 201.
Splinter, W. E., 193.
Srivastava, P. D., 195.
Srivastava, U. S., 195.
Stevenson, J. H., 206.
Suggs, C. W., 193.
Sweetman, H. L., 199.

Telenga, N. A., 208.
Terényi, S., 205.
Thomas, G. W., 197.
Thomas, W. D. E., 208.
Tooke, F. G. C., 170.

van Soest, W., 203.
Venezia, M., 203.

Wallace, L. E., 200.
Walter, E. V., 195.
Watters, F. L., 161, 200.
Wave, H. E., 193.
Weidhaas, jr., J. A., 198, 199.
Weigel, R. D., 182.
Wene, G. P., 195.
Wilcox, J., 191.
Wolf III, J. P., 181.
Wolfe, J. E., 185.

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CONTENTS.

PAGE

AFRICA, EAST: Tests of Insecticides against Pests of Cotton 168
AFRICA, FRENCH WEST: *Balanogastris kolae* on *Cola* Nuts 169
AFRICA, NORTH: A new Eriophyid on Mango in Egypt 167
AFRICA, NORTH: Four Dipterous Leaf-miners recorded from Egypt 167
AFRICA, NORTH: The Bionomics of *Coccinella undecimpunctata* in Egypt ... 167
AFRICA, SOUTH: The Biological Control of *Gonipterus scutellatus* 170
BRITAIN: Investigations on *Eulecanium corni* and a related Species ... 164
CANADA: Pyrethrins with Piperonyl Butoxide against Insects in Elevator Boots 161
CANADA: The Oviposition Sites of *Neodiprion banksianae* 174
CANADA: *Frankliniella tritici* injuring Tree Fruits 175
CANADA: The Identity of a Coccid on Peach 175
CANADA: Moisture and the Situation of Cocoons of *Pristiphora erichsonii* ... 176
CANADA: Scolytids attacking Slash from Lodgepole Pine 177
CANADA: The Development of sampling Techniques for *Choristoneura fumiferana* 177
CANADA: The Action of *Bacillus cereus* on *Pristiphora erichsonii* 178
CANADA: Estimation of Egg Populations of *Pristiphora erichsonii* 179
CANADA: Honey Bees as Pollinators of Lucerne in Alberta 180
CANADA: Effects of repeated Applications of Insecticides to Soil 180
CANADA: Insecticides against *Ptinus villiger* in Warehouses 200
FRANCE: Sprays against *Rhagoletis cerasi* 207
HOLLAND: The Oviposition Habits of *Dasyneura brassicae* on Rape ... 206
HOLLAND: The Bionomics and Control of *Thrips angusticeps* 207
HUNGARY: Tests of Insecticide Treatments against Wireworms 204
HUNGARY: A Bethylid parasitising Wireworms 205
HUNGARY: *Gnorimoschema ocellatella* on Beet and its Control 205
INDIA: Schradan controlling Mites on Cotton 193
INDIA: Soap as Spreader and Insecticide 195
ITALY: Experiments on the Control of *Dacus oleae* 203
ITALY: The Toxicity of Parathion in Olive Oil 203
JAPAN: *Gnorimoschema operculella* and its Life-cycle 208

[*Continued on p. iv of cover*

CONTENTS—*cont.*

PAGE

MADAGASCAR: The Occurrence of Fiji Disease of Sugar-cane 171, 172
NEW ZEALAND: Establishment of *Hylemyia seneciella* on Ragwort 172
NEW ZEALAND: Treatment of Pastures and Contamination of Milk 173
NEW ZEALAND: *Bombus terrestris* as a Pollinator of Lucerne 174
NEW ZEALAND: Collembola damaging Seedling Conifers 174
U.S.S.R.: Part of a Catalogue of the Braconids (*Title only*) 208
U.S.A.: Use of Aeration Systems for applying Grain Fumigants 161
U.S.A.: Sprays controlling *Agrotis orthogonia* on Wheat 181
U.S.A.: Mixed Sprays against *Tetranychus telarius* in Greenhouses ... 181
U.S.A.: The Coleoptera present in Mills in Winter 182
U.S.A.: Response of *Platyedra gossypiella* to Ultraviolet Light 183
U.S.A.: Insecticides controlling *Hylastes obscurus* and *Philaenus leucophthalmus* on Clover 183
U.S.A.: Systemic Insecticides against *Myzus persicae* on Potato 184
U.S.A.: Insects lowering the Quality of Cotton Lint and Seed 184
U.S.A.: Analysis of Counts of Lamellicorn Larvae 185
U.S.A.: Spray Toxicants and the Fauna of Apple Trees 186
U.S.A.: An Outbreak of *Parornix geminatella* and its Control 188
U.S.A.: Nitidulids and the Oak Wilt Fungus 189
U.S.A.: Insecticides affecting Growth of Maize Roots 190
U.S.A.: *Sphenophorus* spp. on Maize and their Control 190
U.S.A.: Sprays and Dusts against *Tetranychus telarius* on Strawberry ... 191
U.S.A.: Aestivation of Pupae of *Hylemyia lupini* 192
U.S.A.: Effect of Hurricanes on Potato-infesting Aphids in Maine ... 193
U.S.A.: Protection of transplanted Tobacco from Wireworms 193
U.S.A.: Sprays against *Carulaspis visci* on Juniper 194
U.S.A.: *Acheta domesticus* and Acaricides 194
U.S.A.: Technique for studying Oviposition of *Lyctus planicollis* 194
U.S.A.: *Oligonychus pratensis* on Maize in Texas 195
U.S.A.: Biological Control of *Diatraea saccharalis* in Louisiana 195
U.S.A.: Insecticides against *Spissistilus festinus* on Lucerne 196
U.S.A.: Lathridiids in Rhode Island and their Control 197
U.S.A.: *Pyrausta nubilalis* attacking Cotton in Missouri 197
U.S.A.: The Overwintering of *Colladonus geminatus* 198
U.S.A.: Control of *Dysmicoccus cuspidatae* on *Taxus* 198
U.S.A.: *Vespa crabro germana* damaging Shrubs 199
U.S.A.: *Ferrisiana virgata* on Azaleas in Maryland 199
U.S.A.: Continuous Rearing of *Anthrenus scrophulariae* 199
U.S.A.: Cultural Factors and Control of *Heliothis zea* on Maize 200
U.S.A.: Sprays against *Pennisetia marginata* on Raspberry 200
U.S.A.: The Spread of *Cephus cinctus* and its Parasites 201
U.S.A.: Insect Transmission of Viruses between Trees and Herbaceous Plants 202
Contamination of Milk of Cows ingesting Dieldrin or Heptachlor 162
The Penetration of Methyl Bromide into Bagged Whalemeat Meal 163
The Bionomics of *Tribolium confusum*, *T. castaneum* and *Latheticus oryzae* 165, 166
Oviposition Rate of *Tribolium confusum* surviving Exposure to DDT ... 175
Hormones and the Diapause in *Cephus cinctus* 179
The Metabolites of Demeton-S 181
The Biological Control of Fruit-flies 185
The Feeding of Larvae of *Mayetiola destructor* 185
The Metabolism of Malathion 186
Hymenopterous Predators as Agents of Biological Control 187
A Method of Tagging large Numbers of Insects with Radioisotopes ... 187
Contamination of Food and Air by Lindane Vapour 188
The Toxicity to Insects of organic arsenical Compounds 191
The Behaviour of *Tribolium* spp. in whole Wheat 192
BHC in Floor Wax for Control of Silverfish 197
Portable Apparatus for sampling Lamellicorn Larvae in Turf 200
Mechanical Transmission of Viruses to their Insect Vectors 201, 202
Effects of Aster-yellows Virus on its Insect Vector 202
Multiplication of Aster-yellows Virus in Preparations of Insect Tissue ... 202
Myzus persicae not imbibing Tobacco-mosaic Virus 203
Behaviour of Schradan and Demeton-S in Plants (*Title only*) 208
A Textbook of Entomology (*Title only*) 208

Printed in Great Britain under the authority of HER MAJESTY'S STATIONERY OFFICE
by The Eastern Press, Ltd., London and Reading.

(2361) Wt. P8510/8911 5/57 E.P. Ltd. Gp. 566. [A]